

PATHOLOGICAL AND SURGICAL OBSERVATIONS,

INCLUDING

A SHORT COURSE OF LECTURES

DELIVERED AT THE LOCK HOSPITAL,

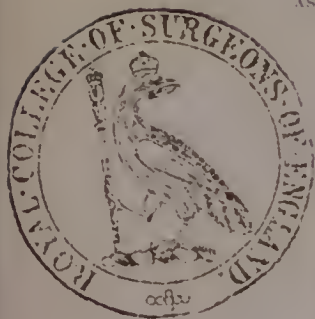
AND

AN ESSAY ON THE SURGICAL TREATMENT OF
HÆMORRHOIDAL TUMOURS.

BY

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TO
JAMES ARTHUR WILSON, ESQ., M.D.,
SENIOR PHYSICIAN TO ST GEORGE'S HOSPITAL,
ETC., ETC.

SIR,

The great English physiologist, who first ventured to base the science of medicine upon the observation of the processes which constitute disease, summed up the labours of his life in a treatise on the blood.

This was a step very far in advance of the age: its consequences on the progress of medical science have still to be developed. As might have been expected, after so great an advance, a period of reaction followed; and for years the literature of our profession had reference almost exclusively to the diseases of the so-called solid structures of the body.

In the school where Hunter taught, and among those who received their education directly from him, it could scarcely happen but that some should be found who had imbibed the spirit of their great master, and who, after his time, would transmit to others the lessons which he taught.

The influence of your opinions has tended in an eminent degree to keep alive in England and in Europe the spirit of

Hunter's doctrines, and has contributed in a marked manner to establish the truth of his ideas concerning the "active living powers" of the blood. I trust I may, therefore, without impropriety, dedicate to you whatever in the following pages may refer to the same general principle. This I am the more encouraged to do, from the consideration that you are still connected with the Hospital in which Hunter taught, where you have so long and so successfully laboured, and where it was once my privilege to study.

I am, SIR,

With much respect, yours truly,

HENRY LEE.

13, Dover Street, Piccadilly.

September 1854.

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INTRODUCTION.

THE present volume contains papers on various subjects : some of these have already appeared in a different form, and some have not before been published.

The essays which have reference to inflammation of the veins, and to fibrinous deposits, are now collected together for the first time, and form a continuation to a work on the same subjects which was printed in 1850. The republication of the author's opinions demands a notice of some able criticisms which have appeared since that time.

The doctrine that different morbid secretions have the power of determining stagnation and coagulation of portions of blood in the living body, and that in the portions of blood so separated, other changes may take place which may communicate irritation and inflammation to surrounding parts, has been questioned, upon the ground that sufficient evidence has not hitherto been afforded that any morbid secretions have the power which has been attributed to them, viz.:—that of producing coagulation of the blood in the living body.

To this it may be answered, that daily observation sufficiently indicates that some influence does often exist in the blood itself, which has the power of producing this effect ; for we constantly find in post-mortem examinations coagula (undergoing changes which could only take place in a state of rest), extending into blood vessels in no way themselves affected by disease ; and that some morbid secretions have the power of determining the production of such coagula may be conclusively demonstrated by experiment, as well as by the observation of cases as they actually present themselves in practice.

The following six Experiments illustrating this point are now recorded, in addition to such as are elsewhere published.

EXPERIMENT I. Some pus, unmixed with blood, was obtained from an acute abscess, which had originated without any very apparent cause in the breast of a young unmarried woman. The pus was immediately placed in a bottle and corked up until required for use. About six hours afterwards a trocar was introduced into the right jugular vein of a donkey which had been well fed and was in excellent condition. The blood flowed freely through the canula when the trocar was removed. A common small glass syringe full of the pus, which was very viscid and tenacious, was now injected through the canula into the vein. The operation was completed without any difficulty. Almost immediately the animal became oppressed, and extended its head and neck in a very peculiar manner. After the lapse of two minutes, an incision was made over the vessel in order

to ascertain beyond a doubt that the pus had been injected into the vein, and not between the vein and its sheath. No appearance of pus existed at this part: a small incision was then made into the vein; it was found not to be blocked up at the part where the operation was performed. A considerable quantity of blood was allowed to flow, in order that any morbid appearance produced by the injection of the pus might not be complicated with simple congestion of any internal part.

It was found very difficult to stop the bleeding, and some four quarts of blood may have escaped altogether. The vein bled as if obstructed below; and, in order to arrest the hæmorrhage, a ligature was placed upon it above the opening: this was done without difficulty, and the bleeding ceased.

The animal now shewed signs of extreme distress in breathing, and looked round repeatedly at its side, indicating the seat of pain. The respirations were very rapid, and accompanied by much heaving at the flanks. This was the great and prominent symptom, and continued until the animal died, which it did three hours afterwards.

The post-mortem examination was performed eighteen hours after death.

The sternum and anterior portions of the ribs having been removed, the heart was opened *in situ*: an extremely firm white fibrinous clot occupied the right ventricle. This was continuous with a clot of similar colour and consistence in the right auricle, and this again was firmly united with a coagulum

darker in appearance, but of somewhat similar consistence, which occupied the right jugular vein.

From the anterior part of the decolorised coagulum in the right ventricle, a firm white cord was continued through the trunk of the pulmonary artery into its two divisions, and from these into some of their minutest ramifications; some of the larger branches of the pulmonary artery were slit up, and the continuous clot from the jugular vein, right auricle, right ventricle, pulmonary artery, and its divisions, were removed together.

The principal divisions of the pulmonary artery alone were opened, but so tenacious was the coagulum, that it was pulled out of some of the smallest branches without breaking. The coagula thus removed were placed on a piece of paper and allowed to dry; a photographic outline of them was then made, and is represented by the plate at the commencement of this work.

Both lungs, but especially the right, when cut into, were found to contain in different parts filamentous prolongations of decolorised fibrin. These often terminated in thicker black rounded coagula; one continuous portion of this tenacious fibrin was found on measurement to be thirteen inches long: another portion, from its first division to its termination, was found to measure eight inches and a half; the part of the lung in which these fibrinous prolongations were most numerous, appeared, to the touch, firmer than the rest; any of these

fibrinous threads as removed, were sufficiently firm to vibrate when held between the fingers.

The following case appears to coincide with the above experiment. A patient died two weeks after a surgical operation; symptoms of extreme difficulty of breathing had suddenly made their appearance three days before death. This was followed by pain in the right side of the chest. Upon a post mortem examination, a large portion of the right lung was found solidified. A small abscess was discovered on the front of the arm, in the immediate neighbourhood of the bones that had been involved in the operation. One of the veins from this part, contained a long slender fibrinous clot, so firm, that when removed and held between the fingers, it would vibrate. The tricuspid valve of the heart, was firmly plastered down by adherent fibrin; so firm was the adhesion, that any attempt to pass the finger from the auricle to the ventricle, was firmly resisted. A bristle only, could be passed in certain directions through the valve. The quantity of blood allowed to pass, towards the termination of the disease, must have been very small.

The preparations illustrating the above experiment and case have been placed in the museum of King's College.

An experiment has lately been published* by Mr. Gamgee, which has some points of resemblance to that above de-

* Association Medical Journal, December 9th, 1853.

scribed; and as it will render the series more complete, it is here recorded, in so far as it bears upon the particular point under consideration.

“A mixture of two drachms and a scruple of good pus, diluted with an equal quantity of water, was injected into the right jugular vein. I had no sooner done this, and transfixed the lips of the orifice with a pin, than the horse began to heave at the flanks, after which he staggered a few moments and fell; when down he breathed laboriously, thirty-eight times in the minute, and, with scarcely a struggle, and not more than two minutes’ delay, expired. The jugular vein and the right cavities of the heart were filled with dark coloured currant jelly-like clotted blood. From the manner in which the experiment was conducted, the introduction of air into the vein was impossible. On examining the blood from the right side of the heart, I discovered on it a very large number of corpuscles, measuring, on an average, one two-thousandth of an inch in diameter, and having nuclei not distinguishable from those of pus cells; so numerous were they, that it was impossible to count them. The lungs were intensely congested, particularly at their bases.”

Mr. Gamgee inclined to the belief, at the time the experiment was made, that the animal had died of asphyxia.* But as in asphyxia, the circulation continues some minutes after the re-

* Ib. February 10th, 1854.

spiration ceases, there appears no reasonable means of accounting for the detention of the pus globules in the right side of the heart where they were found, except by supposing that the coagulation of the blood in that part had commenced before death.

EXPERIMENT II. Chloroform was administered to a dog, and some pus was then injected into a tolerably large vein, near the *tendo Achillis*; a small quantity of water was injected after the pus. This was done in order to prevent the pus from stagnating in the vein in which it was first introduced, and upon which a ligature had been applied. As soon as the operation was completed, the animal was killed by dividing the spinal cord behind the occiput, and the parts were immediately examined.

The lower part of the vein into which the pus had been injected, contained fluid blood. The blood in the vena cava was fluid, as was also that in the iliac and femoral vessels of the opposite side. The femoral vein at its upper part, on the side upon which the operation had been performed, contained a dark coagulum, upwards of an inch in length; this has been preserved as a preparation in the museum of King's College. The lungs were studded in their lower portions with some livid circumscribed patches. The blood in the veins of the body generally remained fluid for a considerable time after the dissection was completed.

EXPERIMENT III. On the 13th of January, 1854, some pus, derived from an acute abscess, was injected into the femoral vein

of a dog. Upon dissection immediately afterwards, a long coagulum was found in the vena cava inferior, and a small clot in the right auricle of the heart. The blood at the time the dissection was made was quite fluid in the other vessels, and in the other cavities of the heart.

EXPERIMENT IV. Some pus recently taken from a very large abscess in the breast of a woman who was suckling, was injected into the left femoral vein of a dog. The animal was immediately killed, and the parts were examined as soon as possible. The vena cava was first opened; the blood here was quite fluid; a director was passed downward, and the iliac and femoral veins opened on each side. The blood was found quite fluid upon the right side, but on the left, throughout the iliac and femoral veins, as far as the opening made during the operation, the whole of the blood was in a semi-coagulated state. Here and there, was a cylindrical coagulum fully formed, and of sufficient consistence, to retain its shape when removed from the vessel. There were no coagula in the heart, nor spots of livid congestion in the lungs. The blood in the vessels generally remained fluid after the dissection was completed.

Corresponding with these experiments, are the results of the following case. A patient had his leg amputated above the knee, and the skin healed by the first intention; a large sloughing abscess, however, subsequently formed in the thigh. The branches of the profunda vein, leading from the seat of the abscess, were found on a post mortem examination to be plugged

with fibrin; a large mass of this, several inches long, extended into the common femoral vein, to which it was but slightly adherent. The passage of the common iliac vein was not obstructed by this deposit of fibrin, nor did the coats of this vessel shew any signs of disease. The plugs of fibrin at the extremity of the femoral artery and vein, contained in their centre some white fluid of the appearance and consistence of pus. A preparation of the femoral vein containing the mass of fibrin, has been preserved in the museum of King's College.

In the thirty-sixth volume of the *Medico-Chirurgical Transactions*, Dr. Mackenzie relates the following experiment.

“The femoral vein of a dog was exposed, and half an ounce of pus, slightly diluted with water, was slowly injected into it towards the heart. In rather more than a minute the dog seemed distressed, the abdominal and respiratory muscles became convulsed, and respiration ceased within two or three minutes. On making a post mortem examination shortly afterwards, the vena cava, and the abdominal and thoracic veins, were found generally turgid with blood. On opening the right iliac vein, a stream of dark-coloured fluid poured out; and on continuing the division of the veins upward, the blood was still found to be fluid, with the exception of two or three small coagula which were found about the middle of the cava. The right auricle contained a thin black coagulum, and small fibrinous coagula were scattered over, and between, the columnæ carneæ of the right ventricle, which contained a minute yellowish-

looking matter, closely resembling the pus which had been injected."

The length of time which elapsed in this case between the conclusion of the experiment, and the cessation of the respiration, together with the time during which the heart's action would continue after the respiration had ceased, would show, as in Mr. Gamgee's case above recited, that some obstruction to the circulation had taken place during life. Had such not been the case, the pus would have passed much farther in the course of the circulation, before the heart's action finally ceased. This view is farther supported, by the disturbance of the respiration during life, and the turgid state of the thoracic and abdominal veins after death. Dr. Mackenzie believes that in such cases the lining membrane of the veins is irritated by the foreign matter introduced, and that when so irritated, it may by a kind of reflex action "so modify the vital properties of the blood," as to give rise to its speedy coagulation. The experiments and cases cited, on the other hand, appear to the author to support the idea which he originally entertained, that the morbid matter acts directly and immediately upon the blood.

The Physiological Society of Edinburgh appointed a committee, in November 1852, to investigate this point, so far as it admitted of being illustrated by experiment. The committee presented their report, containing the details of two experiments performed upon the same animal, in January 1853. In that report it is stated, that, after the conclusion of the second experi-

ment, in which a considerable quantity of pus had been injected into the jugular vein, "the animal presented no unusual symptom whatever. The vein upon which the experiment had been made was pervious, presented no thickening, nor cording, nor abscess."

What the circumstances were, which led to results so different, not only from the author's experiments, but also from those of Dr. Mackenzie and Mr. Gangue above recorded, it appeared difficult to state. It now however seems probable, that the quality of the pus used may have had a material influence upon the result. The pus from an acute abscess is often extremely viscid and tenacious, while that from a chronic abscess does not possess those qualities. From the quantity of pus used in the experiments performed by the Edinburgh committee, it may be inferred, that the pus used was obtained from a chronic abscess. With such pus, the author has also failed to obtain any result. But it must be observed, that if pus be secreted from the lining membrane of a vein, it can only be the result of acute inflammation. The secretion then, would partake of the viscid and tenacious character of pus from an acute abscess, and the particles would be slowly and gradually mixed with the blood, and probably with portions of the disintegrated lining membrane, under circumstances most favourable to its coagulation.

The direct and sudden coagulation of the blood in the living body, is by no means produced only by the presence of puriform

fluids, although these afford perhaps the best illustrations of such results. The following case, for the notes of which I am indebted to Mr. CONWAY EVANS, shew that similar effects may take place not only in the veins, but also in the arteries, where no suspicion has existed of the admixture of pus with the blood.

CASE. James Hunter, æt. forty-four, was admitted into King's College Hospital under the care of Dr. Todd, on the 1st of June 1854. He had been ill for some seven or eight months, and had, as post mortem examination subsequently proved, some tubercles in the lungs, and disease of the kidneys.

On the 26th of May, he had been seized for the first time with extreme dyspnœa. This symptom was so distressing, that it precluded the possibility of his sleeping, even for a few minutes. When admitted into the Hospital, he had had no sleep for four days and nights, and complained only of this, and a sense of anguish about the præcordial region. He sat up at night and laid his head upon the table, that being the only position in which, as he said, he could get any ease.

On the evening of the fourth of June, it was noticed that the left foot was cold and livid; on the fifth, the pulsations could be felt in the left femoral artery, but not in the corresponding dorsal artery of the foot. He died on the eighth, thirteen days after the first attack of difficulty of breathing.

The body was examined fourteen hours after death. The left foot and lower half of the left leg were of a livid blue colour; upon cutting open the left ventricle of the heart, a

quantity of thick discoloured fluid flowed out. Besides this fluid, the left ventricle contained many clots of semi-solid fibrin in various stages of softening. The left common femoral artery, just above the origin of the profunda, was found to contain a dirty white fibrinous clot, which quite filled up the canal of the vessel, but which was not in the least adherent to its inner coat. Below this, the vessel contained a very little red fluid blood, and appeared quite healthy. The popliteal artery contained a mottled coagulum an inch and a half in length, firmly adherent to the inner surface of the vessel, and completely blocking up its canal. Below this again, the vessel was contracted. Its lining membrane was very red, and had attached to it shreds of fibrin. The popliteal vein at this point was obstructed by a clot, and the surrounding tissues were infiltrated and condensed.

The coagulum was so firmly adherent to the lining membrane of the popliteal artery, that a stream of water, allowed to fall upon it from a common jug, at the distance of from eight to twelve inches, did not in the least detach it. The preparation is preserved in the Museum of King's College.

The instances illustrating the coagulation of blood in the living body hitherto given, may be considered as extreme cases, and recorded for the purpose of illustration. Those which usually occur in practice, commence probably from a very small deposit, which forms a kind of nucleus for the formation of further coagula, and which is determined often by some accidental

obstruction in the part. Such cases may be illustrated by the following experiments.

EXPERIMENT V. A very small quantity of pus, from an acute abscess, was injected into the jugular vein of a donkey. The animal was killed, and the vein immediately opened. Some very small flaky coagula were found adhering to its lining membrane.

EXPERIMENT VI. Some pus was injected into the jugular vein of a donkey. The vessel felt full and corded, and the animal was immediately killed. An extensive effusion of blood had taken place between the vessel and its sheath ; the interior of the vein was occupied by a thin coagulum, several inches in length ; no ligature was used to secure the vein in either of the above instances.

Whenever, from any accidental circumstances, a small coagulum forms in the vein of a healthy animal, it is probably dissolved and carried in the course of the circulation, in a very short time, so as to leave no indication of its presence ; but the case is different when the same thing occurs in an animal whose blood is extensively vitiated. Here, instead of being dissolved and carried away, it may serve as a nucleus for the formation of fresh deposits.

In claiming to have established the fact, that certain diseased secretions and morbid fluids will produce the coagulation of portions of blood in the living body, and that the portions of blood so separated will undergo various morbid changes, and

communicate diseased actions to surrounding parts, the author does not intend to infer that similar diseased actions can originate in the neighbourhood of blood vessels in no other way: nor because it is maintained that the constitutional symptoms peculiar to phlebitis, depend upon the morbid products which pass along the interior of the veins, is it intended to imply that severe local inflammation may not be propagated by cellular infiltration of their outer coats.

ON THE CAUSES, CONSEQUENCES, AND TREATMENT OF INFLAMMATION OF THE VEINS.

IN former contributions,¹ I have attempted to establish the following points, in reference to the Pathology and Treatment of Inflammation of the Veins.

1st. That inflammation, both of the veins and of the capillary vessels, usually depends upon irritation, communicated to them through their contents.

2ndly. That pus is capable of producing such irritation when detained in contact with the lining membrane of the veins; but that it may be conveyed along their channels, without leaving any trace of its passage.

3rdly. That pus, under ordinary circumstances, cannot circulate in living vessels, in consequence of its power of determining the coagulation of the first portions of the blood with which it is brought in contact.

4thly. That when pus is carried along a vein, it is in consequence

¹ These are published separately, having formed a dissertation to which the Jacksonian Prize was awarded by the Council of the College of Surgeons in 1850.

either of the disturbance of the coagulum which has first detained it, or of the blood having in some measure lost its natural power of coagulation.

5thly. That when, in consequence of either of these conditions, pus does find its way into the circulation, it may nevertheless determine the coagulation of the blood in its passage, either in a different part of the same vessel, or in distant parts of the system.

6thly. That when the coagulation occurs in a distant part of the body, it is usually observed in capillary vessels.

7thly. That when it occurs in a large vein, it may affect the circulation through the whole of the vessels which supply it; and that if, for example, a coagulum be formed in, or extend to, the common iliac vein, the obstruction produced may give rise to all the symptoms of *phlegmasia dolens*.

8thly. That, under any of the circumstances above mentioned, bleeding and the use of mercurial medicines are of at least doubtful efficacy.

The evidence upon which these propositions are established it is unnecessary to recapitulate. It will rather be my object at present to review some of the labours of physiologists in connection with this subject, and to endeavour, by the assistance of the information derived from the action of foreign substances on the blood, to reconcile the discordant evidence which is found in their writings.

The direct action of foreign matter upon the blood opens an extensive and hitherto comparatively unexplored field of observation to the physiologist; while the admission of diseased secretions into the circulation affords an equally extensive and interesting sphere of study to the pathologist.

The direct effects of extraneous matters, when introduced into the circulation, may be divided into four principal classes, namely:—

I. Those which are occasioned by simple irritation as the foreign substance passes through the vessels.

II. Those which result from the particles of the matter introduced being of such a size, as to pass with difficulty through the small tubes, in which they consequently become entangled.

III. Those which are the result of the coagulation of the blood, determined by the presence of foreign matter.

IV. Those which depend upon a disposition communicated to the blood, to separate into its different parts, or to decompose.

I. Dr. Hales has left us the following experiment. He introduced a tube into the aorta of a living animal, and filled it with a column of water, which by its pressure would inject all the branches with a force supposed to be equal to that of the heart. He then cut a knuckle of intestine, so as to divide the small branches in the length of the intestine, on its free margin. The water from the tube was found to pass from the cut vessels in forty-six seconds, while, under the same circumstances, brandy took sixty-eight seconds before it found its way through the divided vessels. On a second trial, the brandy took seventy-two seconds in its transit.

By the same mode of experimenting, Dr. Hales found that warm water, of the temperature of the animal, passed much quicker than cold water from the pump. He thence concluded, that the contents of the vessels are capable of exciting them so as to contract their calibre, and to diminish the velocity with which fluids are circulated. Mechanical irritation may likewise, as proved by microscopical observation, cause the capillaries of a part to contract, so as to impede the flow of blood through them.

II. In the Museum of St. George's Hospital are preserved different portions of the femoral vein of a man, who was admitted into the hospital in consequence of a severe attack of erysipelas, which produced

several abscesses in the leg and thigh. "The femoral vein is filled with coagula of blood which had manifestly formed before death; and in some parts of the centre of the coagulum, there was found a light semi-fluid substance somewhat resembling pus, but which appeared to be only the dissolution of the coagulum."

It is evident, in such a case, that, whatever may have been the nature of the semi-fluid substance, it was retained in its position by the coagula which surrounded it; and had these been removed, it would then have had free access to the circulation. It is also more than probable that the particles, of which it was composed, were much larger than the blood corpuscles, and would consequently have met with a mechanical obstruction, had they been conveyed in the course of the circulation.

The following case illustrates the circumstance before insisted upon, viz.: the ready access that such vitiated fluids may have to the circulating system, when the coagulating power of the blood has, by disease or other causes, been impaired.

CASE XLI.¹ Win. Stubbs, æt. 30, of a swarthy complexion and emaciated appearance, was admitted into St. George's Hospital, Dec. 25, 1814. A year previously he had suffered from pain in the head and nausea. Three months before his admission, the pain in the head had become very severe, and was accompanied by frequent rigors, occasional vomiting, pain in the epigastrium, and region of the heart. The throbbing pain in the head was occasionally so severe, that he would frequently say that "all the disease was in the head".

He continued in the same state, with occasional rigors, till the 31st, when he vomited incessantly.

¹ The Cases and Experiments are numbered in continuation of those formerly related.

A soft pulpy tumor on the neck now attracted attention, which he said had existed since the beginning of October, when the previous symptoms had become so much aggravated. It was of the size of a small walnut, situated immediately over the carotid artery; pulsating, but not expanding with impulse.

He sank into the semi-comatose state, and died January 9th 1845.

This tumor,¹ upon examination, was found to be a small, perfectly circumscribed abscess, bounded on all sides by condensed cellular tissue. It contained a darkish coloured pus, and corresponded to the middle of the jugular vein. The cavity of the abscess here communicated with the vein by an opening of the size of a pea, and a probe could be passed through the opening into the cavity of the vessel. When first examined, the opening was partly blocked up by a thin coagulum. The internal coat of the vein presented its usual smooth and polished surface, and was but slightly discoloured, except in the neighbourhood of the opening. Here it was somewhat injected, and presented some yellow spots, apparently of pus, on the surface of the inner membrane. The outer covering of the vein was in this situation thickened and partially destroyed; the vein itself contained no blood.

A very small loose clot, presenting anything but the appearance of blood, was found in the right auricle. It was of a brown rusty colour, mixed with streaks of a yellow hue. Examined by the microscope by Dr. Bence Jones, it was found to contain a remarkably small quantity of blood globules; but there existed a great number of large granular cells, the microscopic characters of which did not identify their nature.

It is remarkable in this case, that, although the contents of the abscess must from time to time have partially emptied themselves into the vein, yet, not being detained in it, they had excited little or no irritation.

¹ The *post mortem* examination was conducted by Mr. P. Hewett.

The mode in which purulent fluid, when mixed with circulating blood, becomes altered in its characters, also deserves attention.

The coagulating power of the blood had evidently in this case been greatly impaired; and this circumstance can alone account for the ready admission which the pus gained to the circulation. On the other hand, how completely a coagulum will circumscribe purulent matter before the blood has lost its coagulating power, is illustrated by a case mentioned by Hunter,¹ in which an abscess formed in the substance of the left ventricle of the heart. "The inner wall of the abscess was formed, in this instance, by a solid coagulum of blood of an oval figure. This coagulum was of old standing, from its appearance, and was firmly entangled in the fasciculi of the ventricle."

Experiments illustrating the effects of the introduction of substances into the blood, which have afforded a mechanical impediment to the circulation, have been but too frequently repeated. The following are among those performed by M. Gaspard.

EXPERIMENT XXI. Half a drachm of liquid mercury, in half an ounce of common water, was injected into the saphena vein of a middling-sized dog. The animal, at first, experienced no inconvenience from the operation; but six hours afterwards the respiration became embarrassed, accompanied by fever, symptoms of pain in the chest, and disinclination for food. On the third day the animal appeared slightly relieved, and the appetite was returning when he was killed, fifty hours after the injection.

Post-mortem Appearances. Nearly the whole of the mercury was found to have lodged in the lungs, which were inflamed in hardened circumscribed patches, and in some places hepatised. The mercury escaped from the indurated tissue when it was divided.

¹ Pathological Catalogue of Coll. of Surg., vol. ii, p. 4, from M.S. Cat.

EXPERIMENT XXII. Twenty-two grains of fluid mercury were injected into the jugular vein of a little dog by means of a glass tube. At the expiration of some days, there was a frequent dry cough, with occasional shiverings.

Post-mortem Appearances. The mercury was found, after death, in the lungs, which were inflamed in indurated patches in different parts.

EXPERIMENT XXIII. Twenty-two grains of mercury were injected into the jugular vein of a large dog.

Post-mortem Appearances. Four days afterwards, the mercury was found detained in the lungs, in about thirty inflamed spots of induration, varying in size from a pea to a filbert. In some of these supuration had commenced.

EXPERIMENT XXIV. Two drachms of mercury were introduced into the jugular vein of a very large dog. Six hours afterwards, the animal refused his food, became feverish, and presented the usual symptoms of inflammation of the lungs; subsequently he appeared better, the appetite returned, and a very frequent cough was the only remaining prominent symptom. On the ninth day, a number of globules appeared in the fecal matter, and continued to pass till the thirteenth day, after which they disappeared. The animal's health was now in some measure restored, when he was killed.

Post-mortem Appearances. The lungs were found much altered by inflammation, adherent to the pleura, and solidified; they contained a great number of indurated tumours, filled with pus and mercury. No mercury was found in the other organs, with the exception of a few grains in the pleura, and in the liver. The stomach and the intestines contained a considerable quantity, but none could be detected in the vessels of those parts; some was, however, met with in the œsophagus, in the trachea, and in the bronchi. These

last also contained some *débris* of the pulmonary tissue. The presence of the mercury in the liver is attributed by M. Gaspard, in this case, to its having regurgitated from the right cavity of the heart into the inferior vena cava, and having thence gravitated into the *venæ cavæ hepaticæ*.

These experiments are in accordance with that of Clayton, who, having injected mercury into the jugular vein, found it again four months afterwards in an abscess in the lung.

From all these cases it appears, that liquid mercury cannot circulate in the living vessels, because it becomes mechanically stopped in the capillary system of the lungs, where it impedes the circulation, and causes inflammation and suppuration. It has been asserted, that the abscesses thus found differ in their characters from secondary abscesses, arising from purulent infection. The difference, however, as we shall hereafter see, arises simply from the fact of a larger number of capillaries being obstructed at once (in consequence of the tendency of the blood to coagulate) in the latter than in the former case.

Experiments Nos. XVI and XVII, before recited, show that where mercury is introduced through one of the branches of the aorta, the terminal vessels are affected in the same way as when it is carried along the pulmonary artery. The first system of capillaries to which the foreign matter is sent, is that in which, and in which alone, in these instances, the inflammatory symptoms are developed.

The same principle may be illustrated with regard to the portal circulation. If fluid mercury is injected into one of the mesenteric veins, it is arrested in its progress in the capillary system of the liver, where each globule of mercury becomes the centre of a small patch of congestion, which terminates in suppuration. In all the cases now mentioned, it certainly does not appear to be the size of the globules which prevents the passage of the fluid through the capillary tubes; for, even in the dead body, these may be perfectly

injected with mercury. Another explanation must therefore be sought for, and one presents itself which appears to throw considerable light upon this question. If fluid mercury be agitated with recently drawn blood, it will have little effect in coagulating it *en masse*, but some of the globules of the mercury become very firmly attached to small portions of fibrine, and the two will be found to adhere very firmly together. In this experiment, the fibrine of the blood is no doubt separated to a certain extent from its other parts (as it would be if beaten with a twig), and adheres to the foreign substance with which it is brought in contact. May we not suppose that something of the same kind takes place in the living vessels,—that, as the globules of mercury are shaken with the blood, the latter parts with some of its fibrine, which adhering to the former, prevents it from being carried forward in the course of circulation?

Impalpable powders, when suspended in water and introduced into the blood, are likewise mechanically arrested by the first capillary system to which they are sent. Oily and viscid fluids, as illustrated in the following experiments, are also unable to pass through the minute tubes of the different organs of the body.

EXPERIMENT XXIV. A full half-ounce of chicken's fat, refined and melted, was injected into the jugular vein of a very large dog. The animal was immediately affected with extreme dyspnœa, faintness, and prostration of strength, accompanied by a very slow pulse and inability to stand. An hour afterwards, there were fever, shiverings, symptoms of pain in the chest, and a frequent pulse. These symptoms continued during the second day; and on the third, the animal was enabled to get up and to walk, although with a very unsteady motion. On the second day, the excrements were soft, yellow, pultaceous, and oily; similar evacuations also occurred on the fourth day, after which they were not observed. On the sixth day, the animal was convalescent.

EXPERIMENT XXV. Some mercurial ointment was injected two days afterwards into the opposite jugular vein of the same dog; the quantity employed was about a fourth part of that used in the last experiment. There was immediate prostration of strength; the body was rendered immoveable, and the pulse was reduced to twenty-four beats in the minute. The respiration became very slow and short. An hour afterwards, the pulse rose to thirty, and the respiration became more free. Extreme dyspnœa, however, followed, and the animal died an hour and a half after the injection of the ointment.

Post-mortem Appearances. The lungs were found inflamed and hepatised from the former experiment. The branches of the pulmonary artery were obstructed with a dark concrete fibrinous and elastic clot. This had moulded itself to the branches of the pulmonary artery, and followed its ramifications.

EXPERIMENT XXVI. Three drachms of olive oil, warmed, were injected into the jugular vein of a fox. As in the former experiments, there was complete loss of power; the respiration was interfered with, and the pulse faltered. The animal died at the expiration of twenty minutes.

Post-mortem Appearances. The body was examined four hours afterwards. Some bloody fluid was contained in the bronchi; the venous system, the right cavities of the heart, and the lungs, were greatly gorged with blood. The pulmonary tissue, for the most part, no longer crepitated upon pressure, and portions of it sank when placed in water. Some drops of oil could be distinguished exuding from its structure, which left an oily feeling upon the fingers.

A considerable difference of opinion appears to have existed respecting the effect of the introduction of milk into the veins. Hunter found that the injection of milk into the veins of a dog proved fatal; while M. Gaspard affirms that as much as six drachms may be made to pass into

the circulation, without in any way interfering with the animal functions. In trying the effect of milk upon recently-drawn blood, I find that, if the milk is fresh, it tends to retard the coagulation of the blood; but if it is sour, it promotes it in a very marked degree. It is not improbable, that this circumstance may account for the different effects which have been observed by different physiologists upon this point, and may reconcile the discordant evidence which they have left us.

EXPERIMENT XXVII. A grain and a half of corrosive sublimate, dissolved in water, were injected into the veins of a middling-sized bitch. This was followed by a kind of dysentery, and vomiting of sanious jelly-like matter. From time to time, there was great increase in the secretion of saliva; symptoms of inflammation of the lungs supervened, and death occurred three days afterwards.

Post-mortem Appearances. On opening the body, the rectum was found much inflamed, the liver dark-coloured, and the gall-bladder full of thick viscid black bile. The lungs were studded with a number of little abscesses, separated from each other by nearly healthy pulmonary tissue.

EXPERIMENT XXVIII. A grain of corrosive sublimate introduced into the jugular vein was soon followed by increased secretion of saliva, dyspnœa, and symptoms of inflammation of the lungs. Death occurred on the fourth day.

Post-mortem Appearances. Scattered through the lungs were found very dark tumours, varying in size from a pea to a filbert. Some of these were inflamed, some had suppurated, while others were gangrenous. The liver was dark, and soft in structure; the gall-bladder full of black, thick, and viscid bile.

In repeating this experiment with five grains of the salt, dissolved

in an ounce and of half a distilled water, the animal died in a few seconds.

In these last experiments, we find that the foreign matter is not confined in its influence to the first system of capillaries to which it is conveyed. There is a disposition manifested to expend its morbid action on the liver and the mucous membrane of the intestines—a disposition which we shall find still farther developed in the fourth class of cases above mentioned.

III. Since the time of Ambroise Paré, different surgeons have, with greater or less accuracy, described the abscesses which form in the lungs and liver after injuries to other parts. These abscesses were observed to be peculiar, in the sudden and unexpected manner in which they make their appearance, and also in the circumstance of several of them forming at the same time, leaving the intervening structure of the organ in its natural condition. The want of knowledge of the real way in which they originate, was veiled by ascribing their formation to “sympathetic action”, “metastasis”, “constitutional irritation”, etc. But as such words have been used without any distinct meaning, their place might, perhaps, be advantageously supplied by the term “translation”, employed to indicate that the *materies morbi* is transferred from one part of the body to another, in the manner and under the circumstances which have been already pointed out.

John Hunter was the first, in modern times, to study the actual conditions under which abscesses formed in veins.¹ His observations proved that the internal coats of veins, like the internal surfaces of serous cavities, might become the seat of inflammation, and that such inflammation might terminate in suppuration. “From attentive examination of abscesses of the lungs, he found many appearances which

¹ Medical and Philosophical Commentaries by a Society in Edinburgh, vol. iii.

served to confirm this supposition. He often observed the internal surface of veins leading from such abscesses, not only in an inflamed state, but, in many places, suppurated; and he could even distinctly trace the progress and termination both of the inflammation and supuration."

It is not a little remarkable, that Hunter, having so closely traced the progress of inflammation of the larger veins in the extremities, and also of the smaller veins in the lungs, should have failed to recognise the relation which these so frequently have to each other. Almost all pathologists who have written upon inflammation of the veins, have, in fact, taken for granted, that the injurious consequences produced were necessarily transmitted by continuity of surface. It was therefore natural enough, that the investigation of the effects of inflammation of the veins should terminate with the appearances of irritation of their lining membrane; and as these could rarely be traced in the direction of the circulation so far as the heart, and never beyond it, the consideration of the disease naturally terminated at this point.

In the dissections which Hunter made, he usually found the abscesses which had formed in the course of the veins accurately circumscribed, being separated from the fluid blood by firm coagula. He, however, showed, in a preparation still preserved in the College of Surgeons, that the coagulum might be absent upon one side, and then, he conceived, the purulent secretion might become mixed with the blood. What the circumstances were which determined the formation of coagula in one case, and not in another, Mr. Hunter did not attempt to define; but the following case which he has left on record, leaves no doubt with regard to his having duly appreciated the important office which they perform.

CASE XLII. A man was taken into St. George's Hospital with an inflammation of the arm, in consequence of having been bled in the

basilic vein. He died suddenly at the expiration of eight days. Upon examination, the vein was found inflamed; the inflammation extended from the puncture which had been made by the lancet as high as the axilla; it went also some way down below the puncture. The orifice where the lancet had been introduced was yet open, and a probe could easily be made to pass through it. The coats of the vein were much thickened, and even the coats of the artery were affected in consequence of its vicinity to the diseased part. About the middle of the arm the vein had suppurated, and was divided by the abscess into two. Each extremity, like the internal surface of the abscess, was irregular and jagged. From the cavity of the abscess *there was a free passage into the axillary vein*. The cause of the patient's death was attributed to some accidental change in the position of the arm, by which the purulent matter was mixed with the reffluent blood, and immediately carried to the heart.

In the dissection of horses which had died after bleeding, Mr. Hunter had traced the inflammation to the heart. To this he attributed the death; thereby giving origin to the notion, above referred to, that the fatal symptoms arose from the extension of inflammation in a continuous and uninterrupted manner along the lining membrane of the vessels. In dissenting from this opinion, which has been followed by the very great majority of subsequent writers, it is necessary to remark, that in some of the most rapidly fatal instances, the inflammation has not extended far along the veins; and Mr. Arnott has, by a very careful collection of cases, clearly shown that it by no means generally extends to the heart.

It appears to be a most important fact in connexion with the pathology of this disease, that wherever a coagulum is found to have occupied a vein for any length of time, there the coats of the vessel will be found thickened; but that, on the contrary, no change will be found to have taken place where the circulation has remained unobstructed.

In examining the veins of those who die of phlebitis, it is not at all uncommon to see such portions of them as have been blocked up with coagula, thickened by adhesive inflammation, while intermediate portions (which have contained no coagula, or where these have been only recently formed) remain in their natural condition. Specimens illustrating this point may be seen among Dr. R. Lee's preparations in the museum of St. George's Hospital; and the evidence which they afford is not the less satisfactory from the dissections having been made to confirm other and different opinions.

It must be evident, in such cases, that it is the stagnation of the vitiated blood in contact with the lining membrane of the vein, which produces the inflammation; and we submit, that it matters not at what intervals such stagnation may take place. The essential characters of the disease are the same, whether the poisoned blood coagulates through the whole of a vein, or in its different parts; whether in the vessel in which the vitiated secretion is first formed, or in some distant system of capillaries. It is, in fact, the poisoned condition of the blood, and not the extension of the inflammation to any particular part, which gives rise to the severe constitutional symptoms. The inflammation which is set up in internal organs, after bleeding, thus appears to have the same essential characters as that which affects the vein originally wounded. The disease is merely translated from one part of the venous system to another; and we have, thus, no difficulty in accounting for the multiform character of the secondary affections, of which, otherwise, it would be difficult to offer any rational explanation.

It is important, in the elucidation of the symptoms of this disease, that we distinguish between the coagula formed in veins by vitiated and by healthy blood. The former will irritate and inflame the coats of the veins; while the latter forms the most efficient barrier against the extension of the inflammation. In examining the veins of those who have died of phlebitis, it will sometimes happen that the

lining membrane will appear "blood stained". This may occur either with or without any thickening of the coats of the vessel. It is not difficult to account for this appearance when a coagulum has remained in contact with the discoloured membrane; but it is occasionally observed where no coagulum is found upon dissection. It is extremely probable, in such cases, that the appearance is still due to a coagulum of blood having for some time occupied the vessel, and having subsequently been removed, either by the natural force of the circulation, or by accidental causes.

The following case from the Hunterian MSS. (Cases and Dissections) may illustrate this point:

CASE XLIII. Mr. — received a blow on the right side of the face, which stunned him, but from the immediate effects of which he soon recovered. He was bled; but the wound in the arm opened, and he bled again. An inflammation came on in the arm, which was very severe; and a suppuration at the orifice took place. He was taken with stupor, sleepiness, and sickness at the stomach. It was, at the time, doubted whether these symptoms depended upon the blow he had received, or upon the inflammation of the arm. He continued in much the same state until the twelfth day, when he was seized with a most violent shivering fit. He became as cold as possible, subsequently hot, and then covered by a profuse perspiration. He remained all day very low and debilitated, and his arm had less of the florid red colour than previously. On the fifteenth day he became, in some degree, comatose, lost the power of speech, and died a day or two afterwards.

The preparation of the veins taken from this case, and preserved in the College, shows the cephalic distended through nearly its whole course by a firm clot. This, at the upper part, becomes smaller, and tapers to a narrow flat band, which adheres firmly, by one of its sur-

faces, to the adjacent wall of the vein. The walls of the vein at this and at the lower part, appear healthy ; but, in the intermediate portion, they are thick and tough. The median-cephalic and median-basilic veins, and the lower part of the basilic vein, are similarly filled with firm round clots. *The upper part of the basilic vein is pervious ; but its inner coat is discoloured, being blood-stained.* An attentive examination of this preparation will, I believe, leave little doubt that the discoloration must have been produced by the contact of a coagulum, which, for a certain time, occupied the cavity of the vessel ; and it is not improbable that the period of its dissolution, and its removal into the circulation, was marked by the grave accession of constitutional symptoms, which manifested themselves on the twelfth day.

The intensity of the local and constitutional symptoms may not unfrequently bear an inverse proportion to each other. In the case just mentioned, the inflammation of the arm became less apparent at the very time that the really serious symptoms first appeared ; and, on the other hand, the following case will show that the constitution may remain comparatively unaffected, even in the severest cases of local phlebitis.

CASE XLIV. Thomas Baker, a powerful man, of irregular and intemperate habits, was bled in the left arm, on the 28th of March 1851, having, a few hours previously, been thrown from a horse. He had been stunned at the time of the accident, had broken his collar-bone of the right side, and sustained other injuries about the head and chest. On the 7th of April, the wound made in bleeding, shewed a disposition to suppurate ; a pad was, at this time, placed upon the vein, above the wound, and retained in position by a moderately tight bandage. The inflammation about the orifice now subsided, the wound healed, and no further attention was, for the time, paid to it. Ten days after this, the bandage from his arm having been removed, he

got upon horseback. As the right arm was still disabled, from the fracture of the collar-bone, he was obliged to use the arm in which he had been bled, freely. On returning home, he complained that his ride had "shaken" him.

On the evening of the 19th, a sharp pricking and smarting sensation was experienced about the upper and inner part of the arm. He felt uncomfortably warm, and, of his own accord, loosened the bandages that were about his shoulders. On the 22nd, a vivid red patch of inflammation, the size of the palm of the hand, had formed upon the upper and inner part of the arm. This was of a bright red colour, becoming white for a moment upon pressure. Its outline was, in some parts, tolerably well defined; but, in others, it faded gradually into the colour of the surrounding parts. The inflamed part was very hot to the touch, and exquisitely painful upon pressure. The pulse was quick and full, but not hard; the skin hot, but not dry; the tongue coated with a yellowish brown fur, which was not unusual with him; and the bowels had been freely opened by medicine. The cicatrix of the wound made in bleeding, appeared perfectly well healed, and showed no signs of irritation. A pad was carefully adjusted, so as to make slight pressure over the upper part of the basilic vein; its lower border corresponded with the termination of the redness in the arm. He was ordered bark, with some *liquor ammoniæ acetatis*.

During the two following days, the inflammation extended downwards, in the course of the vessels, and indicated some disposition to spread to the back of the arm. He now continued the bark alone. On the 25th, the redness had extended below the elbow; several large vesicles had formed upon the arm, principally in the direction of the basilic vein; the cicatrix at the bend of the elbow discharged some dark coloured matter,—its edges were tumid and everted; the whole of the inflamed parts were exquisitely sensitive; pulse 108, compressible; he had some comfortable sleep. From this period, the inflammation gradually

spread, involving the whole of the arm; the skin lost its bright red character, and became more livid, and abscesses formed slowly in succession, in every part. The inflammation, which spread so extensively in other directions, never enroached upon the situation of the pad, which had been placed over the upper part of the basilic vein. At the time when the inflammation was most intense, the patient became delirious for three or four nights; but this probably depended upon his having been denied his usual quantity of stimulus. With this exception, there occurred no symptoms to indicate that any vitiated fluid had entered the circulation. In this case no shivering occurred, either at its commencement, or at any other period; thus affording a strong contrast to the case last mentioned.

The extent to which the blood may coagulate in the living body, in similar cases, is remarkable. When the whole diameter of a vein is obstructed at any one point, a mechanical impediment is necessarily afforded to the circulation in the smaller veins which supply it. The blood, then, is placed under circumstances favourable to coagulation in them also, and the same disposition is induced in them as in the larger vessels. The obstruction thus produced in veins will account for the tendency evinced, in some cases, for the inflammation to spread in a direction contrary to the natural course of the circulation; whereas, if the obstruction be only partial, it will follow the course of the blood. It is evident that, under these circumstances, it may become an important object in the treatment to place a limb under those conditions which may favour the formation of a coagulum in the affected vein. The local inflammation may, by this means, be increased; but the constitutional affection is prevented. However severe the local symptoms may be, if there be fibrine enough in the blood to form a coagulum, and seal the vessel, the patient is comparatively safe. This observation applies with even greater force to cases of open or divided veins; such as present themselves after childbirth,

on the inner surface of the uterus ; or, after amputation, on the suppurating surfaces of stumps.

IV. The difference between the effects produced by the introduction of foreign substances into the blood, when they are retained in the first system of capillaries to which they are conveyed, and those which result when they are allowed to circulate with the blood, is strikingly illustrated by the following experiments.

EXPERIMENT XXIX. Fifteen grains of crystallized acetate of lead, dissolved without decomposition in rain water, were injected (a third part at a time) into the crural artery of a large dog. Each injection caused very great pain. The limb, after the operation, became completely paralytic, relaxed, and cold. The pulse and respiration were frequent, and there was a good deal of thirst. In the evening, the limb had swollen, but did not in the least recover its heat, its sensibility, nor its motion. The pain continued unabated. The animal died twelve hours after the experiment.

Post-mortem Appearances. All the organs in the interior of the body were healthy ; but the limb was much swollen, emphysematous, and infiltrated with reddish serum. The muscles had become of a pulpy consistence, and of a reddish-black colour. The lighter structures had assumed a violet colour ; and the whole limb had the appearance of having been affected with gangrenous inflammation.

EXPERIMENT XXX. Four grains of tartar emetic, dissolved in an ounce of water, were injected into the crural artery of a large dog. Some pain was apparently experienced during this operation ; and the animal subsequently walked a little lame upon the affected leg. From the time of the operation, all food was refused ; and violent retching and vomiting came on at the expiration of a quarter of an hour. Much

discomfort and restlessness were now apparent. The pulse was small and feverish; but the limb, when handled, in no wise appeared preternaturally sensible (affording in this respect a strong contrast with the limb in the experiment last mentioned). An hour and a quarter after the operation, a kind of diarrhœa came on, accompanied by a repetition of the vomiting. These symptoms recurred occasionally until about three hours after the injection of the fluid, when the animal died.

Post-mortem Appearances. The limb upon which the experiment had been performed presented nothing unusual. The peritoneum was slightly injected, and contained some reddish serum. The stomach also was slightly injected, but only at its pyloric extremity. The mucous membrane of the duodenum throughout was livid, of the colour of the lees of red wine. This appearance was continued into the jejunum; but the other portions of the alimentary canal were apparently healthy. The liver was congested, and mottled upon its convex surface. In some situations its structure was so altered in consistence, as to break down upon very slight pressure. The gall-bladder was healthy, and full of bile, which was neither thick nor dark coloured. The lungs were studded here and there with a considerable number of petechial spots, or small black patches.

Direct experiment, in these instances, affords us the same information which we obtain from the more lengthened observation of cases as they occur in practice; viz. that foreign substances, when introduced into the blood, in some cases being retained in the part, expend their influence in producing a local, although perhaps a most severe, disease; while in other instances, circulating more freely with the blood, they leave no trace of their entrance into the system, but produce a strictly constitutional affection.

The diseases which we have now to consider, belong principally to the last-mentioned class. It must, however, be remembered, that the

two sets of symptoms continually present themselves, in every shade of intensity, in the same case; and that infected blood, which at one period of the disease goes the round of the circulation, may at another be arrested in some system of capillaries, and give rise to an apparently local disease.

EXPERIMENT XXXI. An ounce of fluid, resulting from the fermentation of some leaves of beet-root, in about an equal quantity of water, was injected into the jugular vein of a very little dog. At the expiration of an hour, the animal vomited. This was followed by evacuations of the bowels, at first of moderate consistence, but subsequently liquid, and consisting chiefly of mucus. Symptoms of dysentery now made their appearance. There was pain in the stomach upon pressure, difficulty of breathing, and expression of much uneasiness. Three hours after the injection, there were complete prostration of strength, inability to walk, or even to stand, and fresh evacuations of gelatinous mucus, tinged with blood. These symptoms were followed by renewed vomiting of glairy bilious fluid, and discharge of urine. The fluid evacuations from the bowels were now repeated upwards of five times, and were very fetid, tinged with blood, and black as if mixed with soot. Under the persistence of these symptoms, the strength became greatly impaired. The animal was affected with convulsive twitchings of the muscles, and died eleven hours after the injection.

Post-mortem Appearances. The body was opened while yet warm. The lungs were found somewhat dark and congested, but free from inflammation or petechiæ. The intestinal canal, from the pylorus to the anus, was covered with a muco-sanguineous fluid, resembling the lees of red wine. The mucous membrane of the intestine was, however, everywhere healthy, except in the duodenum, the commencement of the jejunum, and the rectum. In these situations it was of a

violet red colour, and bore marks of having been inflamed in longitudinal ridges.

EXPERIMENT XXXII. Some beef and blood were allowed to decompose in water, at a temperature of about 80 Fahr. Five ounces of this fluid, which was quite putrid, were injected in divided quantities into the peritoneal cavity of a small dog. After the experiment, there was prostration of strength, vomiting, discharge of fæces with tenesmus, and increased sensibility of the stomach. At the expiration of an hour, the vomiting and evacuations, consisting of gelatinous mucus, recurred several times. The animal died nine hours after the operation.

Post-mortem Appearances. About a pint and a half of bloody serum was found in the peritoneal cavity. This was without smell, and of the colour of the lees of wine. The peritoneum was inflamed, of a violet red colour, and presented everywhere patches of ecchymosis or congestion. The inflammation appeared to have been very great, and was accompanied by the formation of dark patches along the course of the vessels contained in the mesentery. Discolorations were also found at the attached margin of the intestine. The whole of the mucous membrane of the intestinal canal, from the stomach to the anus, was highly inflamed, and of a deep red, violet, or black colour. The folds of mucous membrane which projected into the cavity of the intestine were most discoloured; and in the stomach, these were the only parts inflamed. A glutinous but not bloody mucus was contained in the intestines. The muscular layer appeared in no way to have participated in the affection. The bladder was empty and contracted; it was inflamed on its peritoneal surface, but of its natural appearance within. The left pleura contained some bloody serum. The spleen and the lungs were studded with patches of congestion.

EXPERIMENT XXXIII. The last experiment was repeated on a

large dog. Two ounces and a half of fluid, obtained from putrid beef, not so thick or fetid as in the preceding case, were thrown into the peritoneal cavity. Very great pain was immediately produced. This was followed by prostration of strength, aversion to food, fever without vomiting, alvine evacuations, and death at the end of ten hours.

Post-mortem Appearances. About two pints of bloody serum were found in the peritoneal cavity. The peritoneum itself was excessively inflamed, of a violet red colour, studded with black patches, and presenting here and there inflammatory adhesions and exudations. The bladder was of a deep red colour externally, but quite of its natural appearance within. The intestines were inflamed on their peritoneal surface, but still more so internally. The mucous membrane, from the pylorus to the anus, was thickened, of the colour of the lees of wine, and coated with mucus. Even those portions of the intestines which (in consequence of having been protected from the contact of the morbid fluid) were not inflamed on their serous surface, were nevertheless affected internally.

The general result of the presence of putrid fluids in the system, whether introduced directly into the circulation, or by absorption from serous surfaces, is, as evinced in the foregoing cases, to produce a remarkable affection, peculiarly characterised by congestion of the mucous membrane of the intestines. The evacuations that accompany this condition, are evidently an effort of nature to relieve the system from the vitiated fluids which have entered the circulation; and it is not a little remarkable, that the mucous membrane of the intestines should in these cases be exclusively affected. The appearances produced may be distinguished from the results of common inflammation, in that no thickening or shrinking of the tissues is produced; but they are swollen, congested, and blood-stained, either in petechial spots, in larger patches, or over a continuous surface. The

discharge from the intestines, in such cases, consists chiefly of mucus; but this may sometimes be accompanied by a kind of passive hæmorrhage, and occasionally the secretion may assume a puriform character, without any abrasion of the mucous lining of the canal.

We can readily understand, under these circumstances, that the appearances and symptoms which, a few years ago, were so often observed and described as forming a separate disease, under the name of gastro-enteritis, may frequently have been only secondary results produced by an unhealthy condition of the blood.

When the actions produced by the introduction of putrid fluids into the body are fully developed, all the indications of putrefaction may take place even in the living body. Not only the fluids, but the so-called solids, pass rapidly into decomposition; and the former would appear, in addition to being extremely liable to decompose themselves, to have the property, under certain circumstances, of infecting other parts, and even other healthy bodies. Thus, we read, that during the plague of Marseilles, the bile taken from those who had died of the disease, uniformly produced death when injected into the veins of dogs.

After a putrid element has been introduced into the system, the blood is evidently altered in composition. It becomes black, viscid, and, in a great measure, deprived of its fibrine. After death, it is found fluid, of a very dark colour, and not unfrequently mixed with gas.

It might be, and, perhaps, generally is supposed, that putrid fluids mixed with the blood have the power of preventing its coagulation. The experiments which I have performed on this subject have, however, led me to an opposite conclusion. I have found that the addition of putrid fluids to healthy blood, recently drawn, decidedly promotes this action. It is nevertheless true, that whenever there is manifested a tendency in the body to decomposition, the blood will be found to have lost its power of coagulation; but this effect arises from the continued circulation of vitiated fluid with the blood, and is not the immediate

result of their admixture. It is probable, in this as in the former classes of cases, that the foreign substance gradually abstracts the fibrine of the blood, giving rise to small petechial spots, or small patches of congestion in different parts; and whatever may be the coagulating power of the blood when the putrid element is first introduced, it rapidly becomes impaired, or altogether lost.

Of all the substances with which the experiments have been tried, none possesses the power of coagulating blood so rapidly, and so completely, as pus. To this fact we attribute the formation of the larger patches of congestion found in internal organs when pus has accidentally entered the circulation; and with the more feeble influence of putrid fluids, or of mercury, we naturally associate the formation of the smaller and more circumscribed congestions, in the experiments which have been detailed.

Two principal indications arise from the physiological analysis of these affections. *First*, in phlebitis, strictly so called, there may be, and generally is, a twofold disease, namely, a local inflammation, and a constitutional infection. These, although they occur together, give rise to very different symptoms, and may require very different plans of treatment. It may even be strictly in accordance with the soundest principles of pathology, to use remedies to subdue the violence of the local inflammation, at the same time that tonics are administered to support the general strength of the system. *Secondly*, we learn, by direct experiment, that where a putrid element is introduced into the circulation, the mucous membrane of the intestines and the liver are the principal channels by means of which the elimination of the morbid matter is attempted. The functions of the intestines would appear to fit them in a peculiar manner for this office; and it is probably some power connected with their natural action which determines so large a flow of vitiated blood to their mucous lining. The congestions which arise in other parts, in consequence of a direct infection of the blood,

may terminate in the effusion of serum, lymph, pus, or blood, either separately or mixed together in various proportions. In some rare instances, the secondary inflammation may terminate in resolution; of this the following case affords an instructive example.

CASE XLV. G. B., æt. 31, was admitted into St. George's Hospital for an aneurism in the left groin, for which the external iliae artery was tied. On the evening after the operation, the whole abdomen became painful and tender; the pulse was frequent, the skin hot, and the tongue dry and brown. The patient was bled, and on the following day the bleeding was repeated. The adhesions of the edges of the wound were destroyed, and gave exit to some sanious matter contained within. On the third day, none of the local symptoms were relieved, and the constitutional symptoms were much aggravated. The right shoulder now became affected with intense pain, accompanied by swelling and tenderness. Half a pint of wine was prescribed to be taken daily, with such nourishment as the stomach could receive. The pain in the shoulder, with some degree of swelling, continued for some time; but on the quantity of the stimulus being farther increased, this, as well as the other symptoms, gradually subsided.

This case is interesting, not only as showing that a secondary inflammation may terminate in resolution, but also as indicating the kind of constitution in which such secondary affections are likely to occur. Three months after the patient was discharged from the hospital as cured, the pulsation returned in the tumour, which again enlarged to a very considerable size. It is therefore evident that the coagulating power of his blood had from some cause been greatly impaired: for had this not been the case, the coagula which had been allowed such ample time to form, would have permanently closed the dilated vessel.

ON
THE MUSCLES OF THE EYEBALL,
AND THE NERVOUS INFLUENCES WHICH REGULATE
THEIR ACTIONS.

MOST of the voluntary actions of our bodies are performed by us with reference only to the end which we have in view, while we generally remain unmindful of the mechanism by which they are produced; and with respect to the involuntary motions, which are the most important of all, provision is made for their continuance day after day, quite independently of our will, or even of our consciousness. Each muscular fibre employed in the former set of movements is under the influence of, and guided by, common sensation, or what may be termed the muscular sense. This may be appreciated by, and may act in concert with, the will. Thus we are quite conscious of the amount of effort made in endeavouring to raise a weight, although we do not move it. This sense it is which gives us the knowledge of the exact amount of force required in different muscles, in order that they may concur in producing any movement of the body. If this sense is impaired, or ceases to act in conjunction with the will, the muscles act

irregularly, imperfectly, or not at all. When, for instance, the nerve of sensation has been paralysed in the head of a horse, the lower lip will hang, and the animal will be unable to eat its food, because it does not *feel* the amount of *effort* required in the several muscles to produce a combined action. Or, again, when a person loses sensation in his lower extremities, although the power of motion is unimpaired, yet will he be unable to walk, because he has no means of knowing or of indicating to each muscle the exact share which it should take in balancing his body. This sense may, however, be supplied by another under certain circumstances. Thus, well-known cases have occurred, in which the power of sensation was lost in the hand or arm, and in which anything placed in the hand would drop, the muscles receiving no intimation of the amount of action required of them. But, in such instances, if the eye were kept fixed on the object, it could be retained perfectly well in the hand. Here, the sense of sight supplies the deficiency of the muscular sense. This observation tends to illustrate the way in which the muscles of the eye are regulated in their actions. Unlike other muscles, they have not, or possess in a very imperfect degree, a muscular sense in conjunction with the will; and in this respect their physiological relations are in some degree analogous to those of the involuntary muscles of the body. When the eyes are closed, for instance, we should not know in which direction they looked, were it not that the eyelids occasionally feel the prominent cornea beneath them; or, again, we should in vain require a blind man to fix his eyes upon any given spot; and the evident cause that he cannot do so, is that the sense which governs the muscles of the eye is absent.

The peculiar use of the muscles of the eye, in directing it and adapting it to vision, in fact, requires that their actions should be regulated, not by common sensation, but by the sense of sight; and it appears that under these circumstances we remain unconscious of the amount of effort required in any particular action. A local plan of governing

the movements of the eye is adopted, which does not depend upon, or communicate with, the general sensorium.

If the finger be placed on the eyelid, so as to feel the convex cornea, we shall become aware of the sudden and rapid motions of the eyeball which are habitually taking place, although generally we have no intimation of them when the eye is closed. In every act of winking, the eye is thrown up to the roof of the orbit, which we should never have known from common sensation, had it not been discovered by other means. In these instances, again, it becomes apparent that the muscles of the eye are not regulated by common sensation; but as the eye is nevertheless guided with the greatest precision in every act of vision, we cannot but ascribe the power which controls their actions to the sense of sight: a point in physiology which has not hitherto been duly acknowledged.

It is probably owing to the absence of the muscular sense in this region, that the means employed for the adaptation of the eye to vision at different distances have so long been made the subject of dispute. Could we be conscious of the effort made in altering the focus of the eye, we should probably be at no loss to ascertain the means by which it is effected; but as the adjustment of the eye takes place under the government of its own nervous influence, and is produced by its own construction, we can only reason upon it, without being able to test our conclusions by our sensations.

The muscles attached to the eyeball are of two kinds, the recti and the obliqui. The *recti* muscles arise from the bottom of the orbit, and run in a straight course over the sides, the upper, and the under surface of the eye. The *obliqui*, in man, have a direction backward and outward as they pass to their insertion; but in many animals, whose eyes are situated laterally, they are nearer the front part of the eye at their insertion than elsewhere; so that although in all animals they have a transverse direction (one passing above, and the other below the globe),

yet in some they pass from behind forwards, and in others from before backwards,¹ in reference to the eyeball.

The *recti* perform the office of directing the axis of the eye, turning it to every point in the sphere of vision, and are, as we have seen, under the control of the sense of sight. It frequently happens that one retina is much more sensitive than the other; and under such circumstances, the more feeble impression may be habitually disregarded. The controlling power may then likewise be deficient, and the two eyes may not usually be directed to the same object. A person thus affected will in vain endeavour, by any effort of the will, to direct the wandering eye to any object, as long as the impression of that object remains distinct on the stronger eye, but does so immediately that the more vivid impression is lost. Some individuals become practically aware of the fact, and close the stronger eye in addressing a person situated on the opposite side.

It is necessary for distinct vision, that the impressions on the retina should remain a certain time. If this condition is not complied with, confused images are produced. It is therefore requisite, not only that the eye should be moved from object to object, but that it should be capable of being fixed upon any point upon which the mind is intent. This is equally true, whether the object seen be at rest or in motion, and whether the eye itself be stationary or not. The straight muscles obeying the visual sense are sufficient to direct the eye to any point in the sphere of vision, and to keep it fixed upon such point during the time that the retina is duly impressed; and when the object seen is in motion, the *recti* muscles are all that is required to make the eye follow it as long as it moves in straight lines. But should it revolve upon

¹ As the position of the eye varies in different animals, the terms anterior and posterior, internal and external, are used in reference to the eye, the cornea being considered the anterior part.

its axis, it is obvious that the straight muscles could produce no corresponding motion of the eye. Or, again, if the head is moved in any other but a straight line, the recti muscles have no power of keeping the eye fixed upon an object during the time. In motions of this kind, therefore, in which the relation of the eye to external objects is changed, or when the external object moves in a circle, an apparatus is required by means of which the eye may revolve upon its axis, and so remain fixed with regard to the object seen during the time required for the due impression of the retina. A provision is made for this object in the oblique muscles, which, from their position in different classes of animals, should rather have been denominated "transverse". These embrace the globe of the eye, rotating it on its axis. The action of these muscles cannot be better illustrated than in looking at a carriage wheel in motion. If the eye is allowed passively to rest on the wheel, a confused image is produced, and no part is distinctly seen. But as soon as the separate spokes are observed, the eye is thrown into a series of slight rotatory motions, during each one of which it follows the wheel a sufficient time to see it distinctly. After each such motion, the eye regains its former position, and is again ready to follow the wheel to the same extent as before. Or when we look at an object, and move the head from shoulder to shoulder, the eye is moved in the arc of a circle whose centre is the neck, and the image of the object would be in constant motion upon the retina, were there not a provision for rolling the eye as well as directing its axis. It was formerly supposed, indeed, that the motion of images upon the retina gave the idea of the motion of the objects which produced them. Thus, Keill, in his *Introduction to Natural Philosophy*, p. 79, says: "Those objects will seem to be moved, whose images are moved upon the retina." More accurate observation, however, shows us, that unless the eye is fixed for a certain, although it may be a very short period, upon an object, there can be no distinct perception of it. The

point of sensation, the axis of the eye, and the thing seen, must be maintained, not only in the same straight line, but in their respective relations with regard to position, for a certain time, before a distinct impression can be produced.

The object, as has been observed by Hunter, becomes the fixed point, the centre of motion commanding the direction of the axis of the eye, as the north demands the direction of the magnetic needle; and this relation is maintained during each act of vision, whatever be the motions of the head or of the object at the time. If the head is moved towards the right shoulder, the superior oblique muscle of the right side acts sufficiently to counteract the effect upon the eye until a distinct perception has taken place. The muscle is then relaxed, and again brought into action, so as to allow a succession of distinct visual impressions, as has been illustrated in the example of the carriage wheel. When such a motion, or series of motions, is produced in one eye by the superior oblique, exactly corresponding results take place in the other eye by the action of the inferior oblique. These two muscles consent in their actions as if they were one, and yet we find that they derive their nervous influence from separate sources. Now, as we find every part of the living body fitted by its structure to the exact functions which it has to perform, we cannot doubt that a meaning is contained in this peculiar adaptation, which obtains throughout the whole class of animals that have moveable eyes. What the true interpretation of this particular disposition may be, I will not at present undertake to determine. But I may remark, that as the oblique muscles (taken together) have a double supply of nervous influence, so have they a two-fold office.¹ In all eyes that I have had an

¹ Sir C. Bell has with much justice insisted on the consent which obtains between antagonistic muscles, and has shown by direct experiment, that if a muscle contracts its opponent will relax, and *vice versâ*. Two muscles, supplied by different nerves, may thus have a mutual influence upon each other, and concur in performing a double function.

opportunity of examining, the oblique muscles embrace the eye, and have evidently the power of compressing it. In the cod and jack and other fish, the oblique muscles have a somewhat different relation to the eye to that which obtains in the human subject. They arise from the anterior and inner part of the orbit, and passing backward and outward, nearly in the transverse diameter of the eye, are inserted with the superior and inferior rectus into the upper and under part of the globe. The recti muscles arise very far back in the orbit, and proceed forward as well as outward to their connexion with the eye. They therefore meet the oblique muscles above described nearly at right angles. In birds, the superior oblique muscle arises from the anterior and inner part of the orbit, passes backward and outward, and expands into a flat triangular muscle, being inserted into the most projecting part of the upper surface of the eyeball. The inferior oblique is smaller, but takes the same direction as the superior oblique, and is inserted in a similar manner into the lower part of the eye. In quadrupeds, the oblique muscles have the same origin and disposition as in man, but, owing to the eyes being situated at the side instead of the front of the head, their mutual relations are somewhat altered. In nearly all animals, they proceed more directly across the globe of the eye than in man.

It may be stated generally, that in those animals in which the socket of the eye is large, as compared with the head, and the eye directed laterally, the superior oblique muscle arises from the margin of the orbit, and proceeds backward and outward, or, in many instances, directly outward to its insertion; whereas in those where the socket is comparatively small, it arises with the recti from the bottom of the orbit, and after passing forward, is reflected through a pulley to its insertion. Whatever diversity there may be in the attachment and disposition of this muscle, it has a distinct nerve appropriated to its sole use in all classes of animals. Had its action been exactly similar

to that of the inferior oblique, a branch of the same nerve might have supplied both. The superadded nervous influence implies a superadded function. Now the only action that the oblique muscles can have in all animals, besides that of rolling the eye in its socket, is to compress the eyeball. For although in some animals, from their oblique direction, they might be supposed to influence the direction of the eye, this would not be the case in others. In the swan, for instance, the so-called oblique muscle runs directly across the eye in its transverse diameter. From the observation of the actions of this muscle in man, its use has been assigned, by no ordinary authority, to be that of raising and dragging the eye, in conjunction with the changes to which the other features are subjected "in bodily pain, in agony of mind, and in all this class of passions." But not to mention that there are whole classes of animals in whose features no such expressions ever are recognised, the disposition of this muscle in fishes and birds entirely forbids the idea of any such office being assigned to it.

Although we cannot therefore determine satisfactorily the exact relations of this muscle, yet we infer from what has been said, that it has a twofold action: first, that of rolling the eye; secondly, that of compressing it so as to alter its focal length. But as other explanations equally ingenious have been maintained with reference to the mode in which the eye adapts itself to vision at different distances, we would not here enter upon the discussion, as to whether this effect may not also be produced by other means, but simply observe that the oblique muscles, taken together, have a double function, and a double supply of nervous power. Dr. Hosack, in a paper published in the *Philosophical Transactions* in 1794 (part II, page 222), observed, that external pressure was capable of altering the focal length of the eye, so as to adapt it to vision at different distances. "With a speculum," he says, "I made pressure upon my eye while directing attention to an object

twenty yards distant, and saw it distinctly; but endeavouring to look beyond it, everything appeared confused. I then increased the pressure considerably, in consequence of which I was enabled to see objects distinctly at a much nearer than the natural focal distance; for example, I held a book before my eye at the distance of two inches. In the natural state of the eye I could neither distinguish lines nor letters, but on making pressure with the speculum, I was enabled to distinguish both with ease."

Dr. Porterfield¹ objects to this explanation, that in the jack the oblique muscles "are both situated on the under side of the eye, where they decussate each other in the form a cross", and he therefore argues that the disposition of these muscles is not such as to allow them to compress the globe of the eye. "Had they been so disposed as to embrace the globe in the form of a ring, their contraction might then have squeezed the eye into an oblong form." Having repeatedly dissected the eye of the jack, I am enabled to say positively that the oblique muscles have the very disposition which Dr. Porterfield is here contemplating. His assertion respecting their decussation below the eye, has evidently arisen from mistaking the inferior rectus for one of the oblique muscles.

In all birds, the eye is embraced in like manner, in its transverse diameter, by the two oblique muscles; and when the eye is directed towards the beak, it comes more fully within the grasp of these muscles than at any other time. It is obvious, that in the act of feeding, and using their beaks for other purposes, birds require distinct vision of objects situated very near the eye; and it is equally obvious that rays of light, proceeding from a point near the extremity of the beak, would diverge before they entered the pupil, and would consequently form an image, or come to a focus, at a greater distance behind the

¹ PORTERFIELD ON the Eye, vol. i, p. 124, *et sequent.*

lens, than if they had been parallel before they entered the eye. The range of vision in birds, both with regard to near and distant objects, is probably greater than in any other class of animals, and in them, as in fish, the oblique muscles are always well developed. These considerations lead us towards the solution of the question which has been asked for some hundred years past, namely, why the superior oblique muscle has one nerve distributed exclusively to it; and why that nerve, having a separate origin, and giving off no twig or branch, is sent into the orbit where there are already so many nerves. There may be, and probably are, some finer means of adjustment of the eye to vision at different distances within the organ itself, but we cannot but associate the function of this nerve, which is found in all animals that have moveable eyes, with the means by which such adaptation is produced.

Another adjustment of the eyes, which takes place as rapidly as does that of its focal length, occurs in the adaptation of the axis of the eyes to meet upon any object to which attention is directed. Here, again, we have a special action to be provided for, and a special nerve distributed to one of the muscles concerned. It is worthy of remark, that in this case, as in that of the oblique muscles, one muscle only is supplied by the special nerve, although two muscles (the internal and external recti) are equally concerned in the action. As we have a twofold motion to be provided for, (namely, that of the two eyes together, while their axes remain in the same relation to each other, and also that whereby the relation of the axes is altered, as in looking from a distant to a near object), so we have a twofold supply of motive nervous power.

The external rectus is supplied by the sixth nerve, which is almost exclusively distributed to it; and the internal rectus is supplied by the third nerve, which also supplies the other muscles of the eye. We therefore regard the ordinary motions of the eyes, while they act in

concert, as under the influence of the third nerve, and their different degrees of divergence and convergence we regard as controlled by the sixth nerve. In every act of vision, therefore, there are no less than three distinct motor nerves employed, each of which conveys its mandate with a rapidity and precision of which we have not the means of forming even an accurate conception.

The muscles connected with the eye are peculiar in having the nerves which supply them with motive energy entirely distinct in their origin and course from those which supply them with sensation; and are also peculiar, as we have seen, in having their actions controlled and regulated rather by the sense of sight, than by the sensation which usually presides over muscular action. This peculiarity of disposition displays to us in a wonderful manner the care that is taken to supply every muscle (and every fibre of a muscle) with nervous influence adapted to its peculiar office. In ordinary muscles, the motive power and sentient or regulating influence are communicated through one nerve; and it is not so easy to trace their mutual relations and dependencies, as when these functions reside in different nerves. And although the mode in which the nervous energy is developed is quite as wonderful in the former case, it is more readily appreciated by us in the latter.

We have seen that in every distinct act of vision, the eyes have not only to be directed to their object, but their focal length has to be precisely adjusted; and that the sensations of the retina are the means by which these actions are governed. The rapidity with which they take place is such, that no one probably, unless directing especial attention to the point, would appreciate the interval which elapses between two distinct impressions as the eye runs over the surface of any object, and receives in succession the reflection of its different parts; and yet, for each such impression the sensation of the precise adaptation required has to be received by the retina, transmitted

through the optic nerves, and, reflected again through the nerves of motion distributed to the muscles of the eye. The rapidity of such communications is truly electrical. One of the most striking instances of the rapidity of such communication of sensation, and consequent action of the muscles, is afforded in those instances where gunpowder accidentally explodes in a person's face. The eye takes cognizance of the flash, the information is transmitted to the brain, thence along the facial nerve through a circuitous route in the petrous portion of the temporal bone, to the outside of the face; and the circuit is completed, and the eyelids closed, before a single particle of the powder reaches the surface of the eye.

An important practical inference arises directly from the principle now laid down, in reference to the division of the muscles of the eye in cases of strabismus. If, as I have attempted to show, the muscles of the orbit are regulated and controlled by the sense of sight, it follows, that any defect in that sense may be the cause of an imperfect adaptation and direction of the eye.

The imperfect sensation may arise either from some opacity in the transparent parts of the eye, or from defective action or change of structure in the nervous apparatus connected with it. In the former case, the eye may be obliquely directed, simply in order to oppose the most transparent parts to the object seen; in the latter, in order to allow the focus to fall upon that part of the retina, the sensation of which is least impaired.

In all such cases, where the distortion is not referable to any defect in the action of the muscles themselves, but to the influences by which they are governed, surgical interference is seldom of much benefit; for, as soon as the divided muscle has reunited, it will draw the eye in the same direction as before, and for the same purpose.

ON

A NEW APPARATUS FOR FRACTURED CLAVICLE.

THE principal use of the clavicle in man is to keep the shoulder at the requisite distance from the body, and, by affording it an unyielding support, to enable the muscles to move it, and to maintain it in position. When the clavicle is broken, the shoulder falls in, being drawn by the action of the muscles into contact with the ribs. It also falls, in obedience to the laws of gravitation, according to the position of the body. In the erect position, therefore, the shoulder will be found lower than natural, as well as to have lost something of its lateral prominence.

Different methods have been proposed for the treatment of this fracture. The most common method is the figure-of-eight bandage applied about the shoulders. This keeps the two scapulæ on the back of the chest, and prevents their anterior edges from falling forwards. Some degree of extension is made in this way, but still it rarely happens that the fractured extremities can by this means be brought into apposition; and one reason of this is, no doubt, that it affords no provision against the shoulder falling by its natural weight.

A second plan of treatment, which may, with certain modifications,

be combined with the former, is that of M. Desault. This consists of a cushion, in the shape of a wedge, placed in the axilla, with the broad part upward. The thin point is prolonged so as to reach as low as the short ribs. This cushion is retained in its place by a bandage, and the arm is bound down upon it. The upper part of the cushion thus acts as a fulcrum, the part of the humerus below it as a lever, and the shoulders are by this means drawn asunder. An artificial clavicle is thus formed, while the natural one is being repaired. This apparatus is, however, very difficult to apply, and demands that the patient should be kept at rest afterwards. In a few days, even with the greatest care, the bandage will require to be readjusted, and this necessarily involves a disturbance of the fractured extremities. But the chief objection to this apparatus lies, perhaps, in the circumstance of the cushion resting upon the moveable ribs. As the extending power is always the same, and depends upon the elbow being fixed by an unyielding bandage, it follows, that any motion which is allowed at the point of support, or at the fulcrum, must necessarily be communicated to the free extremity of the lever; and, consequently, in the case before us, would tell upon the fractured portion of the clavicle.

A third plan, which has recently been adopted for fracture of the clavicle, is that which was suggested by Mr. Ellis. It consists in the adaptation of a firm cushion, in the shape of the top of a crutch, to the axilla of the affected side. This rests upon a vertical plate, which reaches nearly as low down as the crest of the ilium. The apparatus is supported and retained in its position by a band extending over the opposite shoulder. Extension is then made by using the arm as a lever, as in Desault's method of treatment; but, as in that, the cushion which forms the fulcrum is constantly liable to move with the motions of the ribs.

Messrs. Philp and Whicker, of 67, St. James' Street, have, at my request, constructed an apparatus, by means of which lateral extension

can be made in cases of fractured clavicle from a fixed point. It consists of a backboard, retained in its position by two broad straps crossing over the shoulders, and by a perpendicular plate reaching to the loins, and connected with a band round the waist; a firm cushion is adapted to each axilla, and extends to the front of the shoulder-joint. To the anterior extremities of these, the straps which go over the shoulders are buckled. Each cushion is directly connected with the backboard by means of a steel bar, slightly concave forward, and capable of being extended laterally and fixed in position by means of a screw. When applied, the two cushions are separated to a convenient distance and fitted to the axillæ. The straps are drawn moderately tight over the shoulders, and the elbow of the affected side is connected with the body by means of a handkerchief or bandage. It is advisable also to support the arm in a sling; and this may be conveniently done by passing a broad band from the elbow in front and behind the arm to the opposite shoulder, below which the cushion in the axilla affords a fixed point for its attachment.

The principal advantage of this apparatus consists in its different parts being so connected and adjusted as not to move with the motions of the ribs; for as these are raised, in all their ordinary actions, simultaneously on both sides, any influence which they possess must be exercised equally in different directions; and as corresponding parts of the apparatus are placed upon the two sides of the chest, any tendency to displacement is exactly met and counteracted by a similar tendency from the opposite side. The result is, that although the cushions rest upon the ribs, they yet do not move with the ribs, but afford firm, and comparatively fixed points of support.

A second advantage of this apparatus consists in its not requiring to be readjusted; should the bandage round the body, or the sling which supports the arm become loose, they may be tightened without in any way disturbing the position of the instrument, or the fracture.

A third point of some importance is, that the arm on the opposite side to the fracture is not confined, and the patient may, in ordinary cases, be allowed to walk about as soon as the instrument is properly adjusted.

In severe fractures of the clavicle, and in such as are complicated with injury to the ribs, it may become desirable to remove all pressure from the side of the chest.¹ This may readily be accomplished by increasing the distance between the two cushions, and connecting *both* the arms with the body. Any amount of lateral extension may in this way be made without any pressure upon the ribs, and even without interfering in any degree with their actions.

¹ It was reported in the case of the late Sir Robert Peel, that he was quite unable to bear the pressure of the ordinary clavicle bandage upon the chest.

ON
SUPPURATION IN BONE; WITH CASES OF ABSCESS
IN THE TIBIA SUCCESSFULLY TREPHINED.

CASE I. James Stocker, æt. 26, came under my care at King's College Hospital, on the 16th June, 1851. He then complained of intense pain in the left leg, which had prevented him sleeping, except at very short intervals, for a month previously. The pain continued without intermission, but was aggravated by occasional paroxysms. At such times, it would first be felt in the tibia, extend thence to the knee, and shoot up the thigh to the hip. This shooting pain was of a most excruciating character.

Upon examination, the shaft of the tibia was found enlarged to double its natural size. The enlargement occupied four or five inches of the bone, being most marked in its middle third, but altogether situated nearer the upper than the lower extremity. Pressure upon the swelling caused no uneasiness, nor did the position of the limb in any way appear to affect the character of the pain. No tender point could be detected in any part of the enlargement. When the pain was most severe, he appeared to derive some comfort from walking about; and he would occasionally get up in the night to do so. The pain and want of sleep had evidently given him a careworn appearance: but as far as the different functions were concerned, he appeared to be in perfect health; nor was there any history of his having suffered from constitutional disease.

He stated that, seven years and a half previously, he had, after some slight injury, first experienced pain in the leg. It was then worst at night, but used to leave him at five o'clock in the morning, "as regular as the clock struck". At that time, the pain lasted for nine weeks, and during the whole period was unaccompanied by any tenderness upon pressure. At different intervals afterwards, he experienced some slight return of the pain, but never so as to cause him much inconvenience, till he struck his shin against a chair, about five weeks before he came to the hospital. On the evening after this slight accident, he felt pain in the leg, which he at once recognised as of the same character as that which he had experienced seven years before. In two or three days the pain became so severe that it prevented him sleeping at night. He used different remedies, in the hope of obtaining some relief, but the symptoms continued unabated up to the time of his application at King's College Hospital.

A blister was now placed over the tibia, and was dressed with equal parts of mercurial ointment and extract of hyoseyamus. He was also directed to take four grains of the iodide of potassium in infusion of quassia three times a-day. This treatment was continued for a fortnight, when the pain had in a great measure subsided. He now took more to drink than he was accustomed to do, and the pain returned with all its former severity. It was, however, still unaccompanied by fever, or by any tenderness of the part. The same plan of treatment as before was adopted, and he experienced a remission from his sufferings for about a week. At the expiration of this time, without any apparent cause, the pain again returned, and a repetition of the medicine was not followed, as before, by any marked relief. I now determined to trephine the tibia, and advised the patient to come into the hospital for this purpose, which he did upon the 12th of August.

The operation was performed on the following day. As there was no spot upon the tibia that was particularly tender, a point was selected

for the application of the trephine which projected, and which felt slightly hotter to the touch than the rest. A common trephine, with a shoulder, was used, as no other was at hand. The instrument in consequence became buried in the bone, as far as it could conveniently go, before it reached the medullary canal. This depended upon the great thickness and increased hardness of the parts, and caused a little delay in the operation. After removing the trephine and reapplying it, some matter was observed oozing up by its side. A complete circle of bone, three-eighths of an inch in depth, was now removed, and an abscess in the medullary canal presented itself. Mr. Fergusson, who was present, observed the peculiarly white and creamy appearance of the pus. The cavity in which it was contained was about an inch and a half in length, and would have held two or three drachms. There was no portion of dead bone connected with the disease, and the matter was not in any degree putrid. The point at which the trephine was applied was exactly six inches from the head of the tibia.

After the operation, the edges of the wound were slightly brought together and covered with wet lint. The pain ceased as soon as the patient had recovered the immediate effects of the operation, and did not again return. On the 22nd of August, the skin had nearly covered the wound, leaving a small opening leading into the cavity of the bone. The tibia itself had by this time considerably diminished in size. This patient was sufficiently well to leave the hospital at the end of a month; and in two months, the bone had nearly regained its natural size.

The following case is from notes taken by Mr. Prescott Hewett, during the time he was house-surgeon at St. George's Hospital.

CASE II. William Mowbray, ætat. 24, was sent up from the country on the 17th of November, 1838, for the purpose of having his leg removed. His constitution was at that time evidently suffering from disease, connected with enlargement of the head of the left tibia. This

was accompanied by constant pain and want of sleep, and was supposed to be connected with some affection of the knee joint. Upon examination, the leg in this situation was found to be nearly an inch more in circumference than upon the opposite side. The swelling, which was prominent and tender at one point, extended for three and a half inches down the inner side of the bone. A dark purple blush occupied the skin, covering its most projecting portion a little below the tubercle.

He stated that, six years previously, he first experienced a dull, heavy pain over the shin bone, which was followed by a swelling below the knee. The symptoms continued unabated for two months, during which time he applied leeches and took medicine. He then changed his residence, for the benefit of fresh air, but the symptoms still continued, and had not entirely subsided for four months more. He now considered himself well, and continued without suffering any inconvenience till three months before his admission into St. George's Hospital. The pain, without any apparent cause, at that time returned, and the upper part of the bone again began to enlarge. Leeches were applied, and mercury given internally, but without benefit. After his admission into the hospital, calomel and opium, sarsaparilla and iodide of potassium, were given in succession, but still without any alleviation of the symptoms.

On the 13th of December, Sir B. Brodie applied a trephine to the head of the tibia, and about three drachms of pus were evacuated from a cavity in the cancellous structure of the bone. This cavity extended upwards to the immediate neighbourhood of the knee-joint. The point selected for the application of the trephine was where the bone was most prominent, and where the greatest tenderness was experienced upon pressure. The operation afforded immediate relief. The man slept well the night following, and from that time improved in health and appearance. In a month, the cavity of the abscess was

nearly filled up, and the patient was discharged, cured, on the 30th of January, 1839.

REMARKS. The disease, of which the above cases afford examples, was originally recognised by Sir B. Brodie in the year 1824; and the symptoms, then observed for the first time, have served to distinguish the affection in the cases which have subsequently occurred. The first case recorded was that of a man, twenty-four years of age, who had a considerable enlargement of the lower end of the tibia. The skin covering the swelling was thin, tense, and closely adherent to the periosteum, but the ankle-joint admitted of every motion, and was apparently



Fig. 1. Abscess in lower end of Tibia, with hypertrophy and much increased vascularity of bone.*

sound. There was constant pain in the part, generally of a moderate character, but every now and then becoming excruciating, keeping

* For the drawings from which the accompanying figures are taken, and for much assistance in other ways, the author is indebted to Mr. P. Hewett, of St. George's Hospital.

the patient awake at night, and confining him to the house for many successive days. The disease had been going on for twelve years, and instead of getting better, became every year worse. At length it was resolved to amputate the limb. The lower extremity of the tibia was found to be enlarged, and its surface presented marks of great vascularity. Just above the articulating surface, there was a cavity in the centre of the bone as large as a chestnut, and filled with dark coloured pus. This cavity was smooth internally, and the bone surrounding it was much injected and harder than natural.

In every healthy inflammation the process of adhesion precedes that of suppuration, and pus when formed is consequently limited and circumscribed by lymph previously effused; but in unhealthy constitutions, the requisite power may be wanting to carry out the process of adhesion; and should suppuration then take place, the purulent fluid may permeate from cell to cell in the surrounding parts. These two processes are exemplified on the surface of the body by a common abscess and a diffuse cellular inflammation. In the cancellous structure of bone the actions are strictly analogous, though somewhat more tardy in their development. The products of the inflammation may be limited by the effusion of bony matter, which fills up and obliterates the surrounding cancelli; or the secretions of the part (when the adhesive process is imperfectly developed) may infiltrate the structure of the bone to an unlimited extent. We have thus a natural division of the cases of suppuration in bone into those which are circumscribed, and those which are not: into cases of abscess, properly speaking, and into those of purulent infiltration.

These two classes of cases differ in their causes, progress, and termination. The simple abscess usually originates in young and healthy persons: the infiltration of purulent matter rarely takes place without some present depressing influence, or some former cause of constitutional weakness. The simple abscess is marked in its progress by

excessive pain, and may continue in much the same condition for many months, or even years. Diffuse suppuration, on the other hand, may be attended with little local suffering, but very soon becomes the cause of much general excitement, and leads to the formation of disease in other parts. The termination of circumscribed abscess is generally favourable, however long it may have lasted, provided the matter be evacuated externally: whereas purulent infiltration in bone is usually fatal.

Chronic abscesses require moreover to be carefully distinguished from cases of softened tubercle, with which they appear to have been confounded. In the excellent memoir of M. Nélaton, published in Paris in 1837, we find the following description of encysted tubercle in the extremity of long bones. "When an encysted tubercle is developed in the extremity of a long bone, it is at first confined in the centre of the cancellous structure, not far from the articular extremity. It gradually increases, and approaches on one hand the cartilage, and on the other the circumference of the bone, external to the joint. If in the progress of its development it reaches the exterior of the bone, it escapes into the surrounding cellular tissue: an abscess is there formed, which increases and empties itself externally, leaving a fistulous communication with the interior of the bone. But if, on the contrary, it makes its way towards the articular surface, the cartilage with which it comes in contact is perforated, and the tubercular matter empties itself into the joint." M. Nélaton says that he has seen several examples of this unfavourable termination of the disease; and his observations are narrated with so much circumstantial detail, that we cannot doubt that he has actually traced the processes which he describes, and has related that which he himself has witnessed. But the cases of crude tubercle in adult bone to be found in our museums are so rare, we cannot but think that the frequency of its occurrence has been greatly exaggerated, and that M. Nélaton, and other conti-

mental writers, have included cases of softened tubercle and chronic abscess under one common description.

I. Chronic abscess may probably occur in any bone of the body. In the museum of the College of Surgeons there is a specimen where it had taken place in the clavicle; and Mr. Arnott has mentioned an instance of its having occurred in the femur. At King's College Hospital a case lately presented itself, where a circumscribed abscess had formed in the lower jaw, the bone around being greatly condensed and thickened. By far the majority of cases of chronic abscess, however, occur in the tibia, and almost always in the upper or lower extremity of that bone. The first case above related offers a peculiarity, the part affected having been towards the middle of the shaft.

When an abscess is formed in bone, important changes occur in the surrounding parts. The periosteum and adjacent bone become inflamed and thickened. This is followed by the formation of new bone, both in the cancellous structure, and on the surface of the original bone. The bony matter thus secreted corresponds to the deposition of lymph around an abscess in soft parts. That which is formed on the surface of the bone is readily recognised. It is disposed in layers, or in small irregular masses (fig. 4), and never presents the fibrous structure of the original bone. This deposition may go on, as the bone in immediate contact with the pus is absorbed; so that, although the abscess is gradually making its way externally, it remains covered with the same thickness of bone as before.

Deposition of new bony matter occurs much more readily around the spongy extremities than upon the compact shafts of bone. In the former situation, it may take place to such an extent, as to render it very difficult to say precisely what part of the bone was originally affected, and a trephine applied under these circumstances may fail to reach the seat of the disease.

The accompanying wood-cut represents a case in which the trephine

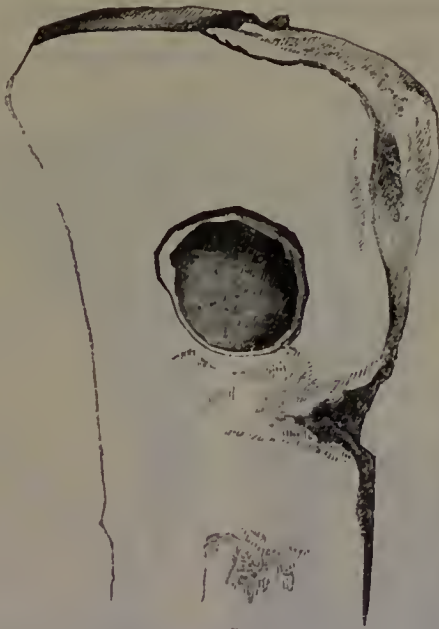


Fig. 2. Abscess in upper end of Tibia, containing putrid pus and dead bone; trephined unsuccessfully. The cavity lined by a dense membrane.

was unsuccessfully applied, and where the disease consequently remained uncured. It also shows the fibrous membrane which occasionally, but by no means always, lines the cavity of the abscess. A similar cyst has been observed in cases of deposit of crude tubercle by M. Nélaton. It is at first gelatinous and semi-transparent; but subsequently becomes firm and unyielding. Examined externally, it presents a rose-coloured tint, dependent upon the vessels extending to it from the neighbouring bone. When macerated for several days in water or alcohol, it is found to be composed of white unyielding fibres interlaced in every direction, and resembling in some respects the structure of the capsular ligaments of joints. In other cases, the abscess is enclosed in every direction by condensed bone, which, when injected, presents a number of small bright red patches, giving, at a distance, the appearance of a continuous vascular layer.

After a circumscribed abscess is formed in bone, the parts around appear to accommodate themselves to its presence. This is accomplished, not by the fibres of the bone being pressed asunder, but by an actual absorption of the osseous substance. The intense pain experienced depends, doubtless, upon the extreme tension maintained upon the unyielding structure, and every fresh accession of pain results from a fresh secretion of fluid. The influence of some medicines in restraining the symptoms may probably depend upon their power of promoting the absorption of the more fluid part of the abscess. Thus

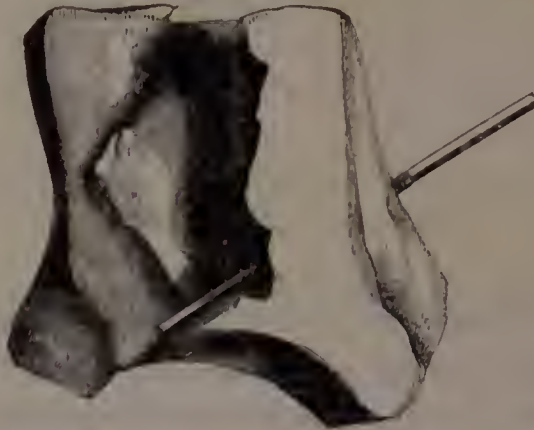


Fig. 3. Abscess in lower end of Tibia, opening externally.

we find that the iodide of potassium, given in doses of three or four grains, will sometimes be followed by a temporary abatement of the pain: and it would appear from the cases recorded, that, after the first attack of pain, the symptoms may remain in abeyance for almost an unlimited period, until some accidental cause produces a fresh secretion of fluid. The cavity of the abscess then again becomes distended, and the pain of compression returns. The pressure of the fluid operates on all sides equally, and tends to cause absorption in every direction. But this is counteracted by the constant tendency to the deposition of new bone. A process analogous to the pointing of an abscess in soft parts not unfrequently takes place; the ulceration affects one point

of the walls of the abscess particularly, and an opening may thus be formed, through which its contents are evacuated externally.

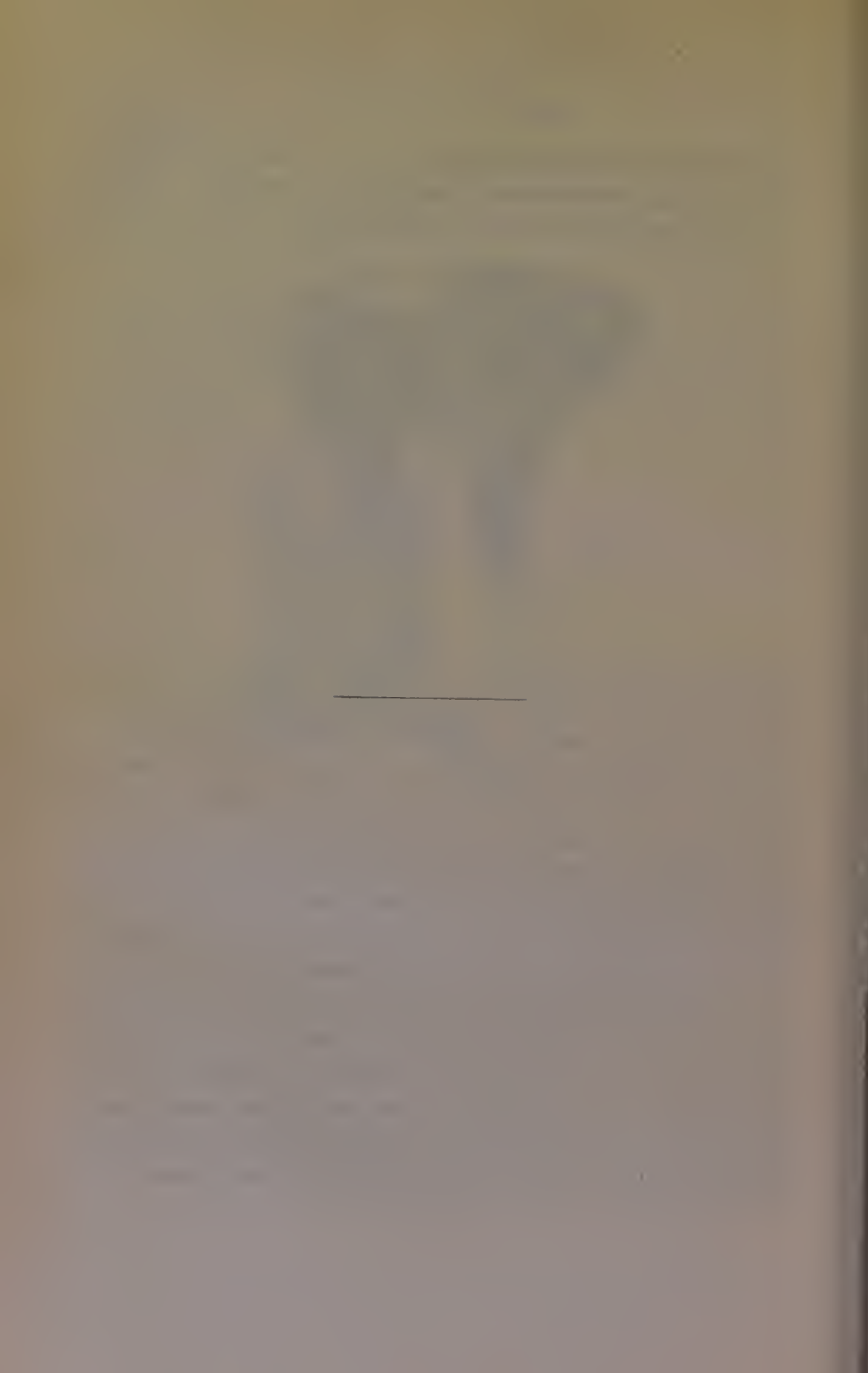
In other cases, the process of deposition goes on in the whole



Fig. 1. Abscess in Tibia, opening into knee-joint.

circumference of the bone as rapidly as that of absorption, and the abscess cannot then make its way externally. The compact structure of the shaft of the bone also prevents it extending in that direction; the articular surface is then the only one towards which the abscess can extend. No fresh layers of bone can here be deposited, and the fluid consequently makes its way towards the joint.

The cartilage has been observed in such cases to be affected in two ways: either perforated, so as to allow the matter to escape directly into the articulation, or absorbed over a large surface without suppuration. In a case of the latter kind, recorded by Sir B. Brodie, the cartilage covering the head of the tibia in some places was perfect in its structure, but it existed only in narrow stripes; in other parts, it had degenerated into a substance something like condensed cellular membrane; in others, the only vestige of it was a kind of membrane, so thin, that the bone could be seen through it; and in other parts, the surface of the tibia was completely exposed, but not carious.



ON FIXED AND LONG-CONTINUED PAIN IN BONE,
NOT NECESSARILY DEPENDENT UPON THE
PRESSURE OF CONFINED MATTER.

THE pain which attends suppuration in the interior of a bone, is not always in proportion to the pressure exercised by the confined fluid. It arises, apparently, in some cases from the tension produced in the condensed bone by the interstitial deposit of fresh bony matter. In other instances, a very small quantity of matter contained in soft spongy bone becomes a source of irritation, and appears to determine to, and fix in the part, some pain depending upon constitutional causes, and which, were it not for the disease in the bone, might have fallen upon some other region. The morbid sensations once established will continue, although not originally produced by the local disease, until that is removed; and even after it has been removed, they will, as if from confirmed habit, shew a tendency to return to their accustomed place. After a time, however, if the cause which has determined the pain to a particular spot be removed, and no fresh source of irritation be present, the symptoms will cease. The piece of bone from which

the accompanying wood-cut is taken, was removed from the tibia of a person of highly nervous temperament, who had for years suffered

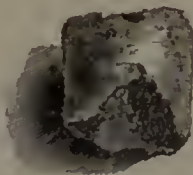


Fig. 5. Portion of thickened but soft bone, removed from a lower extremity of tibia, shewing the cavity of a small abscess.

most severe local pain, and been subject to a great variety of treatment under different medical men. At length the operation of trephining the tibia was performed by Sir B. Brodie. The pain did not immediately cease, but after an interval the patient permanently recovered. The drawing (for which I am indebted to the kindness of Mr. Charles Hawkins) shows how small the cavity was in which the fluid was contained, and the soft and spongy nature of the bone in its immediate neighbourhood.

The following case appears to show, that a constitutional affection produced by syphilis or mercury, may in like manner be determined to, and localised in, a particular bone; and that the symptoms may there be kept up for almost an unlimited time by a very small quantity of matter in its interior.

CASE III. A married woman, of a light complexion, and twenty-four years of age, was admitted an out-patient at King's College Hospital in the year 1849. The left knee-joint was at that time enlarged and painful, a puffy elastic swelling presented itself on the outer side of the joint, affording somewhat the appearance of a dislocation of the patella: very little fluctuation could be detected within the synovial membrane. The whole of the surrounding parts were painful, but the pain appeared to be of a very different character, and much more severe, when the weight of the body rested upon the affected limb, or when the knee-joint was bent. The principal suffering was, however,

experienced at night, and especially after she had become warm in bed. The deep-seated "pain in the bone", would then entirely prevent her from sleeping. This condition had lasted, in a greater or less degree, for a year before she applied to King's College Hospital. Three years previous to this she had been treated for syphilis, and had taken mercury several times.

The joint was directed to be kept at rest, and three or four grains of the iodide of potassium were given three times a day. Under this treatment the swelling soon subsided, and the pain was much relieved. The joint could now be freely examined, and it became evident that the head of the tibia was the principal seat of the disease. Being relieved of her symptoms, the patient now discontinued her attendance. She remained free from pain for a short time only, and again applied at the hospital: a repetition of the former treatment was again followed by complete relief. As soon as she discontinued her medicine, however, the symptoms returned. In this way she continued under treatment for three years, and at one time persevered with the iodide of potassium for six months without any material intermission. As long as she took the medicine she was easy, but upon discontinuing it the pain invariably recurred.

Being tired out by the long continuance of the disease, she now wished, if possible, that something more should be done, and I mentioned to her that permanent relief might possibly be afforded by trephining the head of the tibia, where, as I conceived, some local cause was keeping up the disease. The patient, who before had refused to go into the hospital, now readily consented, for the purpose of having the operation performed. On her admission, the left leg, round the head of the tibia, measured half an inch in circumference more than the right. There was comparatively little pain or swelling, as she had been taking her medicine for some days; but she complained of tenderness upon pressure about the insertion of the liga-

mentum patellæ, and over the upper part of the internal tuberosity of the tibia, which was evidently enlarged. As the shaft of the bone was in no way affected, and the pain and swelling were confined to the immediate neighbourhood of the joint, it appeared that the epiphysis of the bone had originally been the seat of the disease. It became, therefore, necessary to apply the trephine to this part, taking care, at the same time, to avoid injuring the articulation. I had the advantage of Mr. Fergusson's and Mr. Partridge's advice, and the operation was performed with their concurrence.

On the 29th of May, a T-shaped incision having been made over the upper part of the internal tuberosity of the tibia, the parts below were carefully separated with the handle of the scalpel, until the bone was felt with the point of the finger. The trephine, which was made purposely, with a very deep blade, and not more than a third of an inch in diameter, was now applied. As soon as the outer shell of bone was perforated, the cancellous structure was felt to give way under the pressure of the instrument, and some minute and separate flakes of white matter were observed to escape with the blood by its side. After the operation, water dressing was applied, and an opiate ordered at night. On the first of June, the patient stated that her leg had not felt so easy for four years. She had slept well every night since the operation, and was free from pain. There was no fever.

On the 4th the knee felt stiff and sore, and rather uncomfortable, but she had had no return of the "old pain"; a gutta percha splint was placed behind the joint.

5th. She was again free from pain.

7th. There was now, for the first time, some return of what she distinguished as the old pain.

12th. All uneasiness had now subsided without any medicine, and she felt quite comfortable.

18th. Had again some discomfort about the knee, but no further

return of the former pain. The puffy swelling on the outer side of the tibia, which had in a great measure subsided, now increased, and became painful upon pressure; a diseased gland in the neck at the same time began to enlarge. She was ordered some citrate of iron in combination with the small doses of the iodide of potassium, and was directed to get up, as it was supposed that her present symptoms depended in a great measure upon her confinement to bed. In a week after this time she was enabled to leave the hospital, when her general appearance rapidly improved.

On the 24th of August her health was quite restored; she could raise her leg without any pain or inconvenience, and had experienced no return of the "old pain" since leaving the hospital.

The idea of trephining the tibia in this case was suggested by a case which occurred at the Loek Hospital, during the period when I held the office of house-surgeon. A young and delicate woman, after other symptoms which it is unnecessary to detail, became subject to intense and uninterrupted pain in the right thigh. The disease was relieved by none of the means employed, and the patient at length, after most protracted and severe suffering, died, apparently worn out by the pain. On making a section of the bone, I found that its cancellous structure was occupied at different parts by a morbid deposit. This occurred in irregular patches, completely filled the cancelli, and was

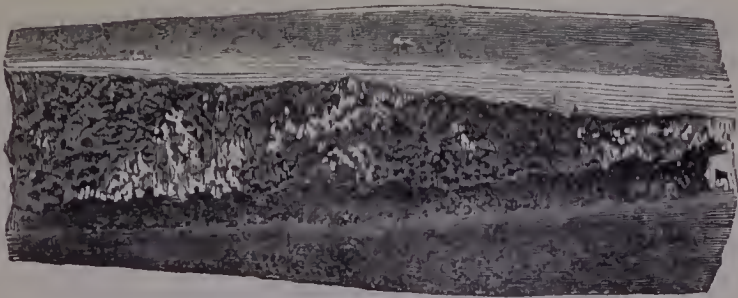


Fig. 6. Representing morbid deposit in bone.

of a light brown colour. It was moderately firm in consistence, and upon a chemical examination by Dr. Beale, of Carey Street, was pronounced to consist chiefly of fatty matter. The parietes of the bone were greatly thickened, and a kind of cancellous structure had been developed between the original outline of the bone and the newly-formed portions.

The extreme distress which this patient endured arose probably from the tension produced by the interstitial deposit of bony matter: whether determined in this individual instance by the presence of diseased matter in the interior of the bone, or not, I will not undertake to say; but, in either case, it appeared probable that the pain which constituted the really serious part of the disease might have been relieved, had a sufficient opening been made in the bone. If the morbid deposit kept up the irritation and produced the surrounding thickening, an artificial opening might at once have afforded relief. The object of such an opening would be not necessarily to remove all the diseased matter in the interior of the bone, but that it might be dissolved and expelled in the subsequent suppuration. If, on the other hand, the real disease were independent of the deposit in the cancellous structure, the removal of a portion of the dense and hard crust of the bone would be the means most likely to relieve the tension of the parts. Such were the considerations which determined me, should an opportunity present itself, to try the effect of making an artificial opening in cases of long-continued pain in bone, not yielding to internal remedies, and following the action of a morbid poison upon the system. In such an experiment there is everything to be gained and nothing to be lost. For should the operation entirely fail in removing the symptoms, the patient is not left in a worse condition than before.

The morbid deposit in the interior of bones to which I have alluded, may, I believe, take place so as to occupy a large portion of their cancellous structure; and that it then becomes a source of irritation

in some cases, I cannot doubt, from the fact of openings being occasionally formed by a natural process of ulceration in bones long affected, as if to allow an exit for the morbid matter. These points are illustrated in the accompanying figure, for which I am indebted to Mr. Harrison, of the Albany Court-yard.

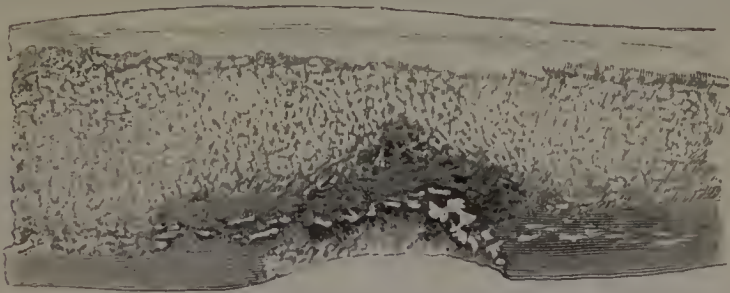


Fig. 7. Showing morbid deposit in bone, and ulcerated opening through its thickened wall.

In the class of cases now referred to, there may be no formation of pus in the bone. In this respect they differ from those previously mentioned. Independently, however, of the actual pressure of the confined fluid, the cases are strictly analogous. The essential characters of the disease may be the same, whether the original cause of local irritation arise from confined purulent fluid, or from a deposit of morbid matter in a more solid form, or from a piece of necrosed bone.

The following somewhat remarkable case came under my observation in the year 1852.

CASE IV. A gentleman, of a highly nervous temperament, had, twelve years before, taken large quantities of mercury for some affection of his throat, which there was no reason to believe was of a specific character. His mouth was kept sore by the medicine for five months, during which time he continued taking it, and, according to his own account, he occasionally took as much as twenty-five grains of blue pill a-day. Six years after this, he had the small-pox, which left him much debilitated.

In the year 1849, he became subject to a very severe cough, which there was reason to believe was connected with a cavity in one of his lungs. His ankles became swollen during the following year, and a pain settled in his left shin. About a fortnight after the first appearance of the pain, he struck his leg severely. The pain then became suddenly increased, and continued without intermission for many weeks. After this he went to Bath, and the symptoms ceased for about three months, but again returned, in consequence, as he supposed, of a very long walk.

In the spring of 1851, the leg was struck a second time, and the pain became of a much more severe character than it had previously been. His cough was now much relieved, and at length entirely left him, while under the care of Dr. Golding Bird.

Three months after his second accident, he became subject to rheumatism, which constantly recurred, and was situated in different parts, but principally affected the lower part of the right thigh. The rheumatism first appeared after the pain in the leg had been temporarily relieved by taking iodide of potassium, in doses of four grains twice a-day.

From the period of the second accident, in the spring of the year 1851, to the time when I first saw him in 1852, the pain in the leg was of a very distressing nature, but was rather better when he walked upon it during the day than at other times. This circumstance is the more remarkable from having been before observed in somewhat similar cases. At night, the pain usually deprived him of rest till between six and eight o'clock in the morning, when the limb generally became bathed in perspiration. After this he would fall asleep. His sufferings were always relieved by the iodide of potassium, which had originally been prescribed for him by Dr. Golding Bird. He usually experienced the benefit of this medicine after he had taken five or six doses in the way above mentioned. While taking this remedy he

slept very well; but as soon as its influence had ceased, the pain habitually returned with all its former severity. He was therefore driven to have constant recourse to it, and, on an average, took about eighty grains a month. He found, however, that although the pain was relieved by this means, that his gums became spongy and apt to bleed, and in other ways it became apparent that the continued action of the medicine was producing a debilitating effect upon his system. He had several times tried to do without his medicine, and wishing not to take it unnecessarily, had continued as much as a month at a time without sleep, excepting the short nap he got after six o'clock in the morning. It was with a view to ascertain whether any surgical relief could be afforded him, that, with Dr. Golding Bird's concurrence, he came to me in the summer of the year 1852.

The leg at this time presented a swelling over the centre of the tibia, evidently depending upon an enlargement of the bone, and about half way between this and the lower extremity of the tibia, was a second smaller projection, which could be distinguished only by passing the finger over its surface. Both these places were very tender to the touch, and the upper one presented at one point a sense of fluctuation, as though a small quantity of fluid were contained between the periosteum and the bone. The night after the leg was examined the pain was greatly increased, and he got no sleep at all.

When requested to point out the part where he suffered the most pain, he would pass his hand generally over the lower part of the tibia; and when asked to define the spot more precisely, he said that he had experienced as much pain as anywhere in the lower of the two enlargements. No one spot, however, could be selected as habitually more painful than the rest.

As this case was in many respects analogous to one before mentioned (Case III), it appeared probable that the symptoms might be relieved by the same means. The tenderness of the bone and the

evident affection of the periosteum, rendered it probable, however, that this, like the previous case, was not an instance of simple abscess of the tibia.

On the 27th of September, the patient having been rendered insensible with chloroform by Dr. Snow, a trephine, five-eighths of an inch in diameter, was applied over the centre of the larger projection about the middle of the tibia. The surface of the bone was here found to be soft, but its substance was hard as ivory, and it was with much difficulty that the trephine was made to perforate it. The original cavity of the bone was found to be occupied by dense bony structure, so that a cylinder of solid bone, an inch in depth, was removed without any cavity or cancellous structure being found. The centre of the portion of bone thus removed was found, when subsequently more carefully inspected, to be softened to a very limited extent.

A smaller trephine, three-eighths only of an inch in diameter, was then applied over the second projection lower down upon the tibia. The bone here was much softer, and before the instrument had penetrated half an inch, a small cavity was opened containing some thin brownish looking matter. This cavity was examined with a probe, and extended a little way up the centre of the bone.

The smaller trephine was now again applied about midway between the two former openings. The bone here was softer than in either of the other situations, and the instrument entered its substance readily. It had penetrated about three-fifths of an inch when a considerable quantity of reddish matter oozed up by its side, and the trephine entered a distinct cavity in the bone; a probe introduced through the aperture passed up to the neighbourhood of the first opening made by the larger trephine. This was therefore enlarged, and a communication established between it and the opening last made. The cavity exposed by the second application of the trephine appeared not to communicate with the other. Had it done so, the matter would have

passed through it, and not have been forced up by the side of the trephine when applied the third time. The two collections of matter, in all probability, corresponded to the two distinct injuries which the part had sustained.

For some days after the operation, the patient suffered severe pain in the leg, but nevertheless occasionally got some natural rest at night. On the 2nd of October he for the first time experienced an interval of complete ease. The pain, when it recurred, had now changed its character. It was rather an excessive smarting than the dull aching sensation formerly experienced.

On the 6th of October, the pain from which he had so long suffered had entirely subsided, but he complained of an increase of the smarting sensation upon the surface. He was directed to apply some flannel sprinkled with chloroform over the leg, but experienced little relief from its use. On the 7th he had some remission from the smarting pain, but it returned again on the 8th. On the 9th, he continued tolerably easy, but the pain again recurred on the following day. On the 11th, a fortnight after the operation, he was free from pain and slept well, although the parts were still tender to the touch. On the 19th and 21st of October he continued free from pain. After this the tenderness in the leg gradually disappeared, and he recovered most satisfactorily.

As the pain in this case commenced before, and continued after, there was reason to suspect any collection of matter in the bone, it could not have depended altogether upon the presence there of confined fluid. When once formed, the matter doubtless continued to maintain the irritation, but the pressure of the abscess, for the reason stated, could not have been the sole and immediate cause of the pain.

In cases where it is deemed advisable to perforate a bone, I have been led to prefer the use of a trephine of a very small diameter in the first instance. It answers the purpose of an exploring trochar in soft

parts, and appears to me to possess the following additional advantages. A portion of bone is more quickly removed with a small than with a larger instrument, and the opening made requires less time to close subsequently. Should the first application of the small trephine not discover the disease, a second, or a third opening can be made without inconvenience. When once an aperture has been made into the bone, a flexible probe introduced and turned in different directions, will generally enable the surgeon to determine what further portion of bone, if any, should be removed. Portions of the affected bone are occasionally very hard, and it may happen that a small segment only of a comparatively large trephine may come upon the softened bone (the remainder of the sawing edge being firmly supported by the condensed and solid structure). The operator will then have no intimation, from the yielding of the softened tissue beneath the pressure of the instrument, of having arrived at the disease; and in cases where, as in Case iv, a very small portion only of the bone is softened, the trephine may be worked deeper than is intended. Such an accident can rarely happen with a small trephine, with which the degrees of resistance of the different parts of the bone are very readily appreciated. It is quite possible, even with a large trephine, to miss an abscess situated in the interior of a bone; and considering the time that its application requires, and the amount of bone involved, it becomes a subject of serious consideration whether a second or a third portion should be removed. The trephines which I have used are about three-eighths of an inch in diameter, and were made for the purpose by Mr. Matthews, of Portugal-street.

In determining where the instrument should first be applied, the most projecting point is to be selected as a rule. But this will not always be the part at which the matter, should there be any, will be found (Case iv). The next best rule is to select the most sensitive spot for the operation; but, as in Case i, there may be no spot pecu-

liarily tender. Perhaps the best guide in such cases is a slight increase in the temperature of the skin, immediately over the seat of the disease, which may be detected by the touch in a certain proportion of cases. Should none of these indications determine the precise spot at which the instrument is to be applied, and should the swelling of the bone extend for some distance, the opening should be made in a dependent situation.

The following case, in which there was no suppuration and no external opening, presents an example of chronic irritation from necrosis, producing a very large deposit of new bone, and giving rise to some of the symptoms, although in a milder form, that were present in the cases of abscess in the tibia before related.

CASE V. A. R., aged 24, was admitted into King's College Hospital, May 21, 1852. Twelve months previously, she had experienced much pain in the left leg. This was attended with swelling and redness extending over the whole limb. After a time, she went into Guy's Hospital, where she remained twenty-two weeks, and then returning home, continued without attendance for three months.

On admission into King's College Hospital, the two lower thirds of the left tibia were very much enlarged; the surrounding skin was red and tender upon pressure; she complained of pain in the leg, which at night was occasionally sufficiently severe to cause her to get up and walk about the room. Generally speaking, she found that the leg was easier when hanging down than at other times. There was no external opening, nor any apparent constitutional or hereditary disease to account for the symptoms. She was kept in bed for five weeks, and some internal medicines were given; but as no benefit appeared to be derived from these means, the operation of trephining the tibia was performed upon the 1st of July. It became apparent during the operation that the bone was very greatly thickened and condensed; and it was with some difficulty that the trephine was made to perforate its

dense substance. When the first portion of bone was removed, the irregular rough surface of some dead bone could be felt beneath. It became therefore evident that the case was one of necrosis. The trephine, which was of small diameter, was now applied to different parts, so as to admit of a considerable portion of the newly-formed bone being removed by sawing between the openings. These would represent the corners, and the lines of the saw the sides, of an oblong. The portion of bone thus raised was half an inch thick at its thinnest part. Between it and the exposed and necrosed shell of the tibia there was no fluid whatever. A portion of the dead bone at the bottom of the wound was now removed in a similar way, and in the centre of the old bone was found a condensed and detached portion of dead cancellous structure. It is unnecessary to give any further details of this case, except to mention that, after the operation, the pain, as well as the redness of the skin of the leg, entirely subsided, and in less than two months she was sufficiently well to leave the hospital.

Strumous deposit in bone may in like manner become the source of chronic irritation and long continued pain. It is seldom, indeed, that crude tubercle is deposited in any quantity in bone, but the following case, for which I am indebted to Mr. Hewett, of St. George's Hospital, will serve to shew that when it does occur the symptoms will bear a certain resemblance to those of chronic abscess. A man was admitted into St. George's Hospital with a tumour situated at the union of the middle to the lower third of the thigh. This tumour was unyielding in its nature and not painful when handled. Fifteen months previously the patient had begun to suffer considerable pain in the bone, of a shooting character. This deprived him of rest at night. Three months afterwards the swelling made its appearance, and gradually increased in size; seven months from the time he was first attacked his health began to fail, and the pain in the thigh had, with few intermissions, been continual and of a severe character. The year follow-

ing his first admission into the hospital, he was attacked with erysipelas, and died. On examining the thigh, great thickening and condensation were observed between the muscles and the bone. The periosteum, which was much thickened, presented, on its free surface, a large patch of tubercular matter, enveloped in a dense cyst. The bone itself was irregular in shape, much hypertrophied, and very hard. Its medullary cavity at this point was filled with tubercular matter, surrounded by gray semitransparent lymph. Deposits of scrofulous matter were also found in other parts.

From the examples now adduced it appears that long continued pain in bone may arise from a variety of different pathological conditions, and that the chronic irritation, which precedes the deposit of new bone, may depend, among others, upon the following local causes:—1. Upon the formation of pus within the bone. 2. Upon the deposition there of more solid material arising from the poisons of mercury, or syphilis. 3. Upon a collection of tubercular matter in bone; or 4, upon the presence of a necrosed portion of cancellous structure.

When the source of the continued irritation is thus situated within the bone itself, it seems not unreasonable to conclude that a similar plan of treatment would be available, from whatever cause that irritation may arise; and the results hitherto obtained would appear to lead to the inference that relief may be expected from an artificial opening in several classes of cases.

Wherever there is reason to suspect that pain in a bone is kept up by the presence of some morbid or foreign matter in its interior, or by the pressure produced by a redundancy of bony deposit, it appears evident that the removal of a piece of the shell of the bone is the rational mode of treatment. An opportunity is thereby afforded at once for the escape of any confined matter, and the tension of the parts

is relieved; and it appears not improbable, from the favourable effects hitherto obtained by this mode of treatment, that it may hereafter be extended to the relief of many cases of protracted and obscure affection of the osseous system.

PURULENT INFILTRATION OF BONE.

WHEN suppuration takes place in bone, and the fluid is neither limited by a cyst, nor by condensed bony matter, it will escape into the surrounding cancellous structure. Any diseased secretions may in a similar way infiltrate a large portion of the interior of a bone, and there produce much local and constitutional derangement. Unless relief be afforded by artificial means, the morbid matter has no way of escape, and can be removed only by being received into the circulation, or by the lengthened process of ulceration or necrosis.

The free communication which exists between different parts of the cancellous structure of a bone is illustrated by a very simple experiment. If a small hole be bored in the sides of an adult bone, and water be injected, it will without difficulty permeate the whole of its interior; or, if the experiment be performed upon the bone of a younger animal, (up to the time at which it attains its full development), the whole of the shaft will be injected, but none of the injection will penetrate to the epiphysis. In like manner, diseased fluids, when they escape into the cancellous structure of bone, beyond the limit prescribed by the adhesive inflammation, are confined only by the dense osseous parietes, or by the junction of the epiphysis with the shaft.

The accompanying wood-cut represents a section of a femur infiltrated with pus, after an injury which had exposed a large portion of the cancellous structure of its lower extremity.



Fig. 8. Purulent Infiltration of Bone.

The line of separation, formed by the junction of the epiphysis with the shaft of the bone, is of much importance with regard to operations involving the extremities of the long bones in young patients. Up to the age of seventeen, and perhaps later, the epiphysis may be separated from a long bone without injuring its structure. In such cases, however much the epiphyses of bones may be injured, (as, for instance, in the excision of joints), there is no probability that purulent or other infiltration will extend to the body of the bone, provided that has not itself been involved in the operation; or, on the other hand, if the shaft of the bone be the original seat of disease, that any morbid action will extend from it to the epiphysis. That diseased actions in bone are generally communicated by infiltration of the cancellous structure, and that such actions cease when they cannot thus be transmitted, is sometimes illustrated in the scrofulous affections of the bones of the fingers in children. The whole of the shaft of a bone may in such cases perish, leaving the articular extremities unaffected; recovery may then take place with a shortened finger, but without any interference with the natural motions of the joints.

The experiment of injecting the interior of a bone will not only show that a very free communication exists between the different parts of

its canellous structure, but also that the injected fluid may be made to pass very readily from the canelli into the medullary vessels of the bone, and thence into the general circulation. If the experiment be performed upon a bone which has just attained its full development, the injection will pass freely from the nutritious vessels of the shaft, or of the epiphysis, according to the situation in which the opening into the bone has been made.

It is easy therefore to understand that disease may readily be propagated, not only from one part of a bone to another, but also from the interior of a bone to different parts of the vascular system. This is doubtless the explanation of the very large proportion of cases, in which purulent infiltration of bone precedes secondary abscesses. In such instances, the course of the morbid action may be traced through the vessels of the bone into those of the general circulation. After amputation of a limb, terminating in phlebitis, for instance, it will sometimes happen that the divided extremities of the veins will show no signs of having participated in the disease, nor will any signs of inflammation be seen for several inches from the surface of the stump. But the first morbid appearances will present themselves in those veins, which are traversed by the blood derived from the nutrient vessels of the divided bone.

It is a point of much interest to trace the mode in which the fatal affection is in such cases transmitted. The following observations and experiments, while they are in some respects peculiarly applicable to secondary affections, resulting from purulent infiltration of bone, are illustrative of similar diseases having their origin in other parts.

So much care has been taken of late years to distinguish purulent from other morbid fluids, and especially from softened fibrin, that the idea appears to have become general, that the latter differs essentially from them, in its morbid actions. Experiments would appear to show that while pus, under certain circumstances, exercises a very different

influence upon the blood to that which is produced by dissolved fibrin, yet that under other circumstances their actions are strictly analogous.

When blood stagnates in one of the larger veins of the body, it undergoes certain changes which terminate in the liquefaction of some of its constituents. Thus, in the decolorised masses of fibrin found in the veins after death, it is not at all uncommon to find the central portions in a fluid state. This change is in exact accordance with Mr. Gulliver's experiments upon fibrin when removed from the body, but maintained at its natural temperature. It appears, however, that this conversion takes place much more readily in certain conditions of the system than in others; and as, on the one hand, the fibro-albuminous portions of the blood may very readily assume the solid form, so on the other hand may these same constituents of the blood, after they have become solid, be reconverted into their fluid state.

CASE. A gentleman, of a gouty habit, had an attack of low, ill-defined erysipelatous inflammation in the leg; at the same time the femoral vein could be felt as a thickened cord at the upper part of the thigh. An incision having been made in the leg, a small branch of the internal saphena vein was divided, and the blood flowed from it as it would have done from an artery, but without pulsation. This evidently depended upon the blood being prevented from following its natural course by the obstruction in the femoral vein. The blood which flowed from the wound was received on a sponge in some warm water. Almost immediately it separated into its different parts. The decolorised fibrin floated in firm shreds in the water, and adhered in the same condition to the sponge upon which it was received. Some of this fibrin was collected; and, having been separated as far as possible from any admixture of water, it was placed in a clean bottle and corked up. When collected, it was quite as firm as fibrin usually is, and it required some little pressure to force some of the portions

through the neck of the bottle. No artificial heat was in this case applied, but on the following day, the whole of the contents of the bottle had become reconverted into their original fluid condition.

The readiness with which the fibro-albuminous portions of the blood may undergo the change from the fluid to the solid, and from the solid to the fluid form, is a point of considerable interest in tracing the mode in which diseased actions, originating in purulent infiltration of bone, may extend themselves first to the veins of the part, and subsequently to the general system. When fibrin, which has been allowed to become fluid by decomposition, is mixed with recently drawn blood, it will determine its rapid coagulation. In this respect, the action of dissolved fibrin is analogous to that of pus; but there is this important distinction between the two, that, whereas the coagulum formed by pus is particularly firm, that determined by decomposed fibrin is loose, and however long it is kept, it does not become more solid.

The experiments which I have before published, illustrating the peculiar action of pus upon blood, have been repeated by several persons, and especially by Mr. Millington of Edinburgh. The observations of this gentleman led him to the conclusion, that, whereas pus added to living blood determined its rapid and firm coagulation, putrid fluids, on the contrary, either retarded or altogether prevented such an action. From experiments which I have myself made with putrid fluids, I believe that this is sometimes the case; but it is not so with regard to fibrin which has become putrid by decomposition. It is to be remembered, that the blood in the living body is peculiarly subject to the action of decomposed fibrin; and it is in perfect accordance with the usual economy of nature to find the sensibilities of a part actively alive to those influences which are calculated to affect it injuriously. The blood forms no exception to this general rule. Its sensibilities for its self-preservation are as evident as those of other parts of the body, and are called into play in an especial manner

in reference to those injurious influences to which it is peculiarly liable. It is seldom that the blood is subject to the direct action of putrid vegetable matters, or even to the putrid secretions from animal bodies. But it is in an especial manner open to the influence of portions of liquefied fibrin, which for a time has stagnated in some part of the vascular system. The following experiments will show how readily the contact of such is felt by the living blood, and also the means adopted for the preservation of the general mass of the circulating fluid from its deleterious influence.

EXPERIMENT. Some fibrin of the blood was obtained quite firm, free from any colouring matter, and was kept and allowed to decompose. At the expiration of three or four weeks, it had become fluid and of a dirty light brown colour; a small portion of this was now mixed with some recently drawn blood from a bullock which had just been knocked down. In two minutes from the commencement of the experiment the mixture had formed an uniform soft coagulum: a similar quantity of unmixed blood, taken at the same time, remained fluid several minutes afterwards.

This experiment was repeated with some of the same fibrin in a more advanced stage of decomposition. A half pint of blood was taken from a horse in perfect health, and to this was immediately added a quarter of an ounce of the putrid fluid. The whole coagulated loosely in a minute and a half. The coagulum was kept till the next day, but did not become firmer than it was after it had first coagulated. The effects obtained from the action of decomposed fibrin on living blood are thus shown to be different, both from those produced by ordinary putrid fluids on the one hand, and by pus on the other. The experiment appears to prove, that in case any putrid fibrin should find its way into a blood vessel, the same means would be in force to limit its influence, to seal the vessel, and to protect the system against its circulation, as would happen if some healthy pus

had been similarly introduced. But the soft and loose coagulum in the one case, although as rapidly formed, affords much less protection to the constitution, than the firmer and adherent clot in the other.¹

When the fluid fibrin has attained a very great degree of putridity, the coagulum formed may not be of sufficient consistence to resist the circulating power of the blood. The morbid poison, when introduced into a vein, will under such circumstances pass without obstruction into the system. The effects produced then offer a strong contrast to those which result from a similar introduction of pus into the circulation.

The following experiment illustrative of this point was performed for me by Mr. Mayer, veterinary surgeon. A young, and perfectly healthy ass was secured, and the right jugular vein exposed. An ounce of fluid, derived from the spontaneous decomposition of portions of the fibrin used in the two former experiments, but in a much more advanced state of putrefaction, was mixed with an equal quantity of water, and injected by means of a syringe into the exposed vein. The vessel did not become "corded", and the circulation was not apparently impeded, as happens when a similar experiment is made with pus. In a few moments, the animal gave three or four groans expressive of much distress. The vital powers at the same time appeared to be suddenly prostrated. The animal was unable to rise, and soon fell into a state of syncope.

The faintness lasted for a few minutes. On getting up, the animal reeled and staggered about for some time, and then recovered sufficiently to walk to his stall. Some reaction now commenced, the breathing was disturbed, short, and quick; the pulse 120 in the

¹ It is important to notice that these observations apply only to fluid fibrin in a putrid state; whether the effects of fluid fibrin which had not undergone decomposition would be similar, I have not had an opportunity of ascertaining.

minute, small and wiry. These symptoms continued for about an hour and a half, when the animal became very restless and uneasy, evincing internal pain by groaning and looking at his side. All food and water were refused, and death followed four hours after the operation.

On a *post-mortem* inspection sixteen hours after death, the jugular vein, into which the putrid fluid had been injected, was found in its natural condition, partially distended with fluid blood. It was pervious through its entire length, and contained no coagula. The lungs were studded with irregularly circumscribed, soft, black patches. When cut into, these discharged a black fluid, having the appearance of a mixture of blood and ink, and of a strong putrid smell. The heart had liquid blood in both its cavities. The cæcum and colon and a portion of the small intestines were deeply congested, and of a dark livid colour. There was an effusion of many pints of serum of the peritoneal cavity; this, as well as the blood throughout the body, had a putrid and very unpleasant smell.

In this case, the putrid injection either prevented the coagulation of the blood in the body, both before and after death, or had the effect (in the event of any coagula having been formed) of determining their speedy reversion into a fluid state. These results afford the strongest contrast to those produced by the introduction of pus into a vein. In the latter case, the immediate and firm coagulation of the blood presents a barrier against the admission of the contaminated blood into the circulation; or, if by any means this first means of localising the morbid matter should prove abortive, the tendency of the infected portion of the blood to coagulate is evinced in some distant part of the system. In cases where it reaches the lungs, it there produces firm spherical patches of livid induration, not unlike in appearance to those observed in the experiment last quoted, but differing altogether from them in consistency. In the one case,

the patches of congestion are produced by the firm coagulation of portions of contaminated blood; in the other, the blood has lost its vital properties together with its power of coagulating, and is already in a state of incipient putrefaction.

In the first instance, the affected portions of lung are firm, and an interval is required before they can become softened down; in the second, dissolution commences in the soft pulpy portions immediately. These general considerations will enable us to trace the progress of disease from a portion, and often a very small portion, of injured cancellous structure of bone to the general system; and to account for the lapse of time which, in the great majority of cases, occurs between the receipt of the injury and the development of its constitutional effects.

When a portion of the cancellous structure of a bone has been injured, the blood in the Haversian canals of the injured part becomes necessarily stagnant between the point of injury and the next communicating branches. These stagnant portions of blood usually become coagulated and gradually absorbed. If the wound in the bone should suppurate, they at first serve the very important purpose of closing the vessels against the entrance of the secretions of the part: an office which is subsequently much more permanently performed by the process of adhesive inflammation. It will occasionally happen here, as in the larger veins of the body, that the contents of the injured blood-vessels will become mixed to a greater or less extent with the secretions with which they are in contact. This may arise from some accidental mechanical cause, or from some inherent defect in the coagulating power of the blood.

The admixture of diseased secretions will determine the coagulation of those portions of the blood with which they come in contact, and thus the coagula will extend farther along the vessels than they would have done, had the blood at first firmly sealed the divided extremities of the veins. Uncontaminated blood will remain for a long time in

the living body, either in its solid or fluid state, without undergoing much alteration; but this is not the case when the blood has become mixed with vitiated fluids. Farther changes will then readily take place in it; and we may judge of what takes place in the minute vessels of bone, by that which can be better observed in the larger veins of the body.

There appears no doubt, from evidence derived from direct experiment, that a coagulum formed of vitiated blood may, and often does, in healthy states of the constitution, become gradually and entirely absorbed and eliminated from the system by the intestinal and hepatic secretions; but at other times, the vitiated and perhaps loosely formed coagulum becomes softened down and poured into the adjacent veins. It here determines one of the three following physical results.

1. The dissolved matter of the first formed coagulum mixing with fresh portions of blood may lead to the formation of fresh coagula. These may retain for a time the vitiated fluid; and, adhering at intervals to the sides of the vessels in which they are contained, they may prevent any of the foreign matter from reaching the general circulation. Within a short period, however, the centre of the newly formed coagula will become softened and gradually deprived of its colouring matter. The process of softening will proceed from the centre towards the circumference of each portion, until nearly the whole is converted into a white fluid resembling pus. Should there be an opening in the bone, this may escape externally; but otherwise, increasing in quantity by the secretions of the surrounding parts, it is forced forward in the course of the circulation to contaminate and mix with fresh portions of blood, which, in their turn, first become coagulated, and then softened down, and converted into the same purulent looking fluid. If an opening be made in a bone in which this process is going on, not only the cancellous structure, but the Haversian canals will appear filled with pus. It occasionally happens under these

circumstances, that on making an opening into a bone, a distinct little jet of purulent looking fluid may be seen to escape from one of the canals of the nutritious vessels. In such a case, the cavities of the vessels must of course be accurately closed by firmly adhering coagula in the surrounding parts.

The effects of purulent contamination of the blood usually extend in the course of the circulation.

CASE. A man, twenty-six years of age, had a blow upon the head which fractured his skull, causing at the same time a scalp wound, which left a portion of the bone denuded. Eighteen days afterwards, he complained of pain in the head, accompanied by nausea. To this succeeded what he termed "soreness of the stomach", which was soon followed by drowsiness and insensibility. He then became paralysed, and a good deal of irregular muscular twitching was observed in different parts of his body. He died a week after the commencement of the above symptoms. Yellow matter was found in the diploë of the parietal bone in the neighbourhood of the fracture, and purulent looking fluid, mixed with flakes of fibrin or lymph, occupied the *posterior half only* of the longitudinal sinus.

It sometimes, however, happens that the effects of the disease extend in a course opposite to that of the circulation. In these instances, it is probable that the whole mass of the blood has become, to a certain extent, contaminated. When such is the case, those portions which are kept at rest are the most liable to become first coagulated and then softened down. This is not unfrequently observed in cases of infection of the blood after childbirth. The blood in the common iliac vein will become coagulated in consequence of some diseased fluid poured into it from the uterus. This will cause the blood in the femoral and saphena veins to stagnate. Portions of the contaminated and stagnant blood in these, and in the vessels which supply them, will then become coagulated and undergo subsequent changes, in-

volving the coats of the veins and neighbouring parts. Thus the disease will appear to have extended downwards, in a course contrary to that of the circulation. In the same way we must explain the curious fact, that after amputation of one leg or thigh, an abscess will occasionally form in one of the veins of the opposite limb. In such cases, *post-mortem* examinations sometimes show that the coagulation of the blood has extended from the amputated limb to the vena cava. An obstruction there would of course act equally upon both sides of the body. It is a remarkable fact in these instances, that the coagulum will never extend beyond the opening of the hepatic veins; the double current from the portal system and from the veins opening into the inferior cava being sufficient to carry forward any viscid contents of the vessel.

2. When the blood has become infected, instead of coagulating, it may separate into its different elements. In this case the fibrin is left unmixed with either the serum or the colouring matter of the blood. This process differs from that of coagulation in this, among other important particulars, namely, that whereas a coagulum formed of all the parts of the blood fills the vessel which contains it, the separation of the blood into its different parts leaves the fibrin alone in the vessel, and allows the more fluid parts to pass on into the general circulation. The consequence of this is that the vessels in which such an action has taken place still remain pervious. The blood can still pass between the fibrinous deposit and the walls of the vein in sufficient quantity to carry on, although imperfectly, the natural circulation of the part; such a condition, unlike that of coagulation of the blood, offers no security against the passage of any diseased secretions along the vessels. This tendency to the separation of the blood into its different parts was strongly marked in the blood which has been detained in the saphena vein in the first case above related. It would appear to be an action which not very unfrequently takes place in the

body, although necessarily difficult to illustrate with regard to the smaller veins. I have lately, however, had an opportunity of observing this change in the capillaries of the liver. From each small tube a delicate thread of fibrin could be drawn, leaving some of the fluid parts of the blood in the vessels, which were stained of a darker colour than natural.

CASE. An old man had a large tumour removed from the back of the arm. Some veins on the surface of the wound were observed to be greatly distended with black blood. A few days after the operation he was attacked with erysipelas, which terminated in mortification of the part, and death. The axillary vein was found to contain a firm portion of decolorised fibrin, which extended into the neighbouring veins, and about half filled the vessels in which it was enclosed. Nearer the wound the blood was of a very black colour, and quite fluid.

A case lately published in the *Gazette Médicale de Paris*, affords a very good example of this separation of the fibrin from the other elements of blood. The patient was a soldier, who died in St. Michael's Hospital, having suffered for a long period with symptoms of disease of the chest. Four months before his admission into the hospital, without any apparent cause, and in a single day, the eyelids and the cheeks became considerably swollen. The lower extremities and the forearms became at the same time œdematous. Upon a post-mortem examination, the vessels of the left lung were found to contain fibrinous concretions, having the form of ramified cylinders, which extended through the pulmonary artery into the right ventricle of the heart. These concretions were white, or of a rus-colour, solid and resisting. They adhered but very slightly here and there to the lining membrane of the vessels, and were in some parts of the pulmonary artery, and of its larger branches, surrounded by a layer of semi-fluid black blood.

A similar condition has been observed with regard to the vessels of

the brain; the longitudinal sinus has been observed to contain a firm yellow fibrinous mass, extending on the one hand in an arborescent form to the vessels of the pia mater, and on the other to the jugular veins.

In such patients the sudden increase of the symptoms may mark with tolerable certainty the period at which the greater part of the fibrin is deposited, but this would appear to take place gradually in the majority of instances; and it is probable, as in the case of the soldier above mentioned, that it may exist for a long period, during which the circulation may be carried on sufficiently for the purposes of life. Upon a post-mortem inspection, the firm decolorised fibrin may at once be distinguished from the blood which has coagulated around it after death.

3. The contaminated blood, instead of coagulating, or of separating into its different elements, may decompose. The whole of the constituents of the blood are then together involved in the changes which take place. The experiments above related shew that the same impediments will not, under such circumstances, be offered to the passage of morbid matter into the circulation as when the blood firmly coagulates in the veins. An interval, however, even in the most strongly marked cases usually elapses between the development of the infecting cause and the manifestation of constitutional symptoms. This is especially the case where diseased secretions enter the circulation through the nutritious vessels of bone. The morbid matter is detained for a certain time, during which the process of decomposition is established. The first infected portions of blood, together with the morbid matters which they contain, then pass on to infect the blood in adjacent vessels. The dissolved and putrifying fibrin from these proceed further towards the centre of the circulation; in its course it will loosely coagulate fresh portions of blood, and then determine their decomposition. Every additional quantity of blood that is infected will

add to the amount of putrid dissolved fluid in the vessels, and thus the disease will propagate itself, quite independent of the original source whence the morbid matter was derived. Each portion of blood which is attacked loses its vitality, passes into a state of decomposition, and becomes itself the means of infecting other portions. The contaminated blood may then be found in the vessels in every stage of decomposition, or it may have passed out of the vessels in which these changes have taken place, having stained them of a deep livid colour. Long tracks of purple veins will occasionally be found, some being blocked up with the viscid blood in various stages of putrescence, and some having discharged their contents, and being comparatively empty.

CASE. A man of rather intemperate habits, received a kick from a horse on the right leg, on the 15th of October, 1851. The right tibia and fibula were fractured, and the fracture communicated with a wound in the skin. He was purged, and kept upon low diet. On the 22nd, some redness was observed around the wound, and the cellular tissue in the neighbourhood felt boggy. On the 1st November, he vomited after taking food, and on the following days he had several attacks of shivering. On the 4th, his complexion was yellow; he experienced no pain. Five days after this he died.

No union had taken place between the fractured extremities of the tibia, and the parts immediately around the broken portions of the fibula were in a sloughing condition. The superficial and deep veins of the leg and thigh were greatly distended with dark thick blood, but contained no coagula. The iliac veins contained small soft and dark coagula, but were otherwise healthy. In the middle of the right lung were two patches of secondary inflammation, and the right lobe of the liver contained several secondary abscesses, surrounded by firm and dark texture.

The examination of the following case, conducted by Dr. J. W. Ogle, I had the opportunity of witnessing through the kindness of Dr. Wilson,

of St. George's Hospital. A married woman, twenty-three years of age, miscarried, during the sixth month of her pregnancy, on the 4th of June, 1851. A few days afterwards she was attacked with intense pain in the abdomen, and two or three days later with pain in the calf of the left leg. The pain in the leg was accompanied by some swelling, which afterwards extended up to the thigh. She died on the 11th of July.

A small putrid abscess occupied the course of one of the branches of the left hypogastric vein, at a short distance from the neck of the uterus. The iliac and the femoral veins of the same side were filled with blood in every stage of decomposition. The spermatic vein of the same side was stained of a dark purple colour, but its canal was pervious and contained no coagula.

When the blood in one of the larger veins of the body decomposes, as in the preceding case, the period at which severe constitutional symptoms follow is comparatively short. Analogous affections originating in the minute vessels of bone, for the reasons above stated, usually require a longer period for their development. This is illustrated in the following cases.

H. B., aged 19, sustained a fracture of the fibula. Three months after the accident, and three weeks before his death, he had an attack of diffuse cellular inflammation in the leg, which terminated in suppuration of the knee-joint. Upon examining the limb, the tibia in the neighbourhood of the fracture was exposed, and its structure was soft and of a black colour.

J. C., aged 45, had an extensive scalp-wound. Nineteen days afterwards, he experienced a rigor, and shortly became paralysed on one side. A portion of the skull, which was exposed, presented a dark green appearance, and when removed with the trephine, was of a putrid odour. The longitudinal sinus in this case contained contaminated blood, and there were secondary abscesses in the left lung.

In some cases, where the most severe constitutional symptoms have followed injuries of bones, the original lesion has appeared of no very great importance, and the surface of bone exposed has been of very limited extent. In the following instance, the original injury was not regarded with any apprehension, yet it proved speedily fatal after the appearance of the symptoms of secondary inflammation.

E. P., aged 50, had a lacerated wound of the foot, which detached a small portion of the base of the fifth metatarsal bone. This bone was also simply fractured towards its centre. After having for some time progressed without any unfavourable symptoms, pain in the chest, a rapid pulse, depression, with delirium, suddenly made their appearance, and were found, on a *post-mortem* examination, to have arisen from inflammation of the right pleura, and the formation of secondary abscesses in the right lung. The amount of contaminated blood contained in the injured bone must in such instances be very small; and there can be little doubt that recovery would take place much oftener than it does, did not the disease propagate itself in the blood. When this takes place, it is usually indicated by one of the three classes of physical changes above described. The different natural processes which they illustrate may, however, take place in various degrees in the same case; and the condition of the blood upon *post-mortem* inspection will, in different parts of the vascular system, present corresponding varieties.

When either by coagulation, or by other means, a portion of fibrin is separated from vitiated blood, the separated portion will adhere to some part of the vascular system, and further changes may take place in it. These changes have an important reference to the development of secondary disease in distant organs to which their products may be conveyed. The following example is interesting, first, as showing that the changes observed may have their origin in the fibrin of the blood itself, quite independent of any inflammatory action in the surrounding

solid structures; and, secondly, as illustrating the direct connexion which exists between such changes and the formation of secondary abscesses in the lungs.

CASE. John Hallott, aged 37, was admitted into King's College Hospital under my care, during Mr. Fergusson's absence, on the 20th September 1852. Six months previously he had fractured his patella. He recovered sufficiently to be able to walk in three months, but always experienced a sense of stiffness in the joint.

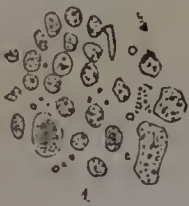
On the 17th of September, he was attacked, at two o'clock in the morning, with a succession of rigors, which continued till the middle of that day. An abscess subsequently formed in the knee-joint, and the cellular tissue between the muscles of the leg and thigh were extensively infiltrated with pus. The shiverings were repeated on subsequent days, and were followed by most profuse and exhausting perspirations. He died on the 16th of October.

Upon a post-mortem examination, the patella was found to be softened in some parts of its cancellous structure, while other portions were much firmer than natural. One part of its posterior surface was rough and carious, and lying in contact with this exposed surface was a small detached portion of dead bone. The profunda vein of the affected side was filled with coagula, but the superficial femoral contained only a small quantity of fluid blood. At the junction of the two veins was a considerable mass of decolorized and adherent fibrin. This was easily removed from the lining membrane of the vein, which then presented its usual polished appearance. No sign of inflammation, though carefully looked for, could here be discovered. Upon gently pressing the mass which had been removed, a small quantity of perfectly white purulent-looking matter escaped from its interior. This was carefully preserved, and its microscopical appearance is represented in the accompanying woodcut.

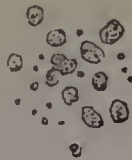
At the lower part of the right lung were found some small oval

deposits of white matter, as firm in consistence as an ordinary tubercle. In other parts of the same lobe were larger indurated masses, containing in their centres some discoloured puriform fluid. Some of this was also carefully collected, and my friend Dr. Beale did me the favour to compare it with the fluid obtained from the adherent fibrin in the femoral veins. For the drawings from which the accompanying woodcut was made, as well as for the following note, I am indebted to Dr. Beale.

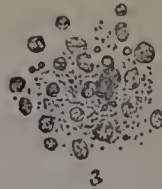
Fig. 2.



1. Cells from the clot in the vein.



2. The same treated with acetic acid.



3. Cells from secondary deposit in lung.

Drawn with the camera. Magnified 200 diameters.

“EXAMINATION OF PORTIONS OF PURULENT-LOOKING MATTER
TAKEN FROM A VEIN, AND FROM A SECONDARY
ABSCESS IN THE LUNG, BY MR. LEE.

“The mass from the vein was found to consist chiefly of delicately granular cells of an oval, or more or less circular, outline, about the size of a pus globule, but varying somewhat in dimensions. These cells were more transparent, and the outline not so well defined as that of a well-developed pus globule.

“Scattered at irregular intervals amongst them, were observed a few cells of about twice their size, and also containing granular matter, and here and there an oil-globule could be distinguished. There were present also a few ill-defined bodies, closely resembling the granular cells in structure, but of an elongated irregular form, a few free oil-globules, and free granular matter. Upon the addition of acetic acid

the cells became more transparent, and the outline of the cell-wall less distinct; at the same time the granules within were seen more distinctly; but in no instance could any of the characteristic bodies which appear upon the addition of acetic acid to pus globules be discovered.

"The purulent-looking matter from the lung, in general appearance, resembled that above described, but for the most part the cells were somewhat smaller, and not so distinctly defined. The quantity of free granular matter was greater, and there were also a few free oil-globules. Acetic acid affected these cells in a similar manner to those obtained from the femoral vein.

"LIONEL BEALE."

"27, *Carey Street*, October 16, 1852."

As in this instance the lining membrane of the vein from whence the altered fibrin was taken was in its natural condition, the development of the granular cells must have originated in the coagulum itself; and as the fluid contained in the secondary abscess in the lung so nearly resembled that from the softened fibrin in the femoral vein, we are led to the conclusion, that in both cases this purulent-looking matter was formed in the same way, and that the morbid process which led to its formation had its origin in the changes produced in portions of vitiated blood. Such changes may be the cause, but are not always, at least, the consequence of inflammation in surrounding parts.

ON THE DEPOSITION OF FIBRIN ON THE LINING MEMBRANE OF VEINS.

M. GENDRIN, in his *Histoire Anatomique des Inflammations*,¹ cites an experiment upon which much stress has been laid by subsequent writers, and from which the existing theory respecting the mode of formation of lymph in inflamed vessels has derived much of its support.

If, says M. Gendrin, an irritating injection be thrown into a portion of an artery included between two ligatures, emptied of its blood, and washed, the inflammation which follows is characterised by the formation of a plastic layer, which lines the internal membrane, and ultimately fills up the cavity of the vessel. This is accompanied by an obscure redness of the lining membrane, which is not under the circumstances stained of a violet red colour by the imbibition of the colouring matter of the blood, as happens when the vessel is filled with the coagulum.²

In repeating his experiments upon veins, M. Gendrin arrived at similar results, but found that the lining membrane of these vessels increased in thickness to a greater extent than that of the arteries,

¹ Paris, 1826.

² Tom. ii, p. 13.

that they suppurated more quickly, and that they always afforded readily a concrete layer of lymph, which obliterated the vascular canal.¹

Hassé, in his *Pathological Anatomy*, has followed Gendrin, and believes that the induration of inflamed veins depends partly upon the coagulated blood which they contain and partly upon the lymph secreted from the lining membrane into their interior.

English pathologists have generally adopted the same view, and coagulable lymph is spoken of by them as capable of being effused as readily on the lining membrane of veins as upon the peritoneum or pleura. The writers who have thus regarded the internal surface of the veins as analogous, in a pathological point of view, to a serous cavity, are so numerous that it might seem superfluous to refer to any individual treatises upon the subject; but, if necessary, quotations might be taken from works of pre-eminent authority, not only in this, but in every country of Europe. Thus, in the first sections upon diseases of the veins in Mr. Hodgson's most justly celebrated work, it is stated that "the veins are liable to all those morbid changes which are common to soft parts in general; but the membranous lining of these vessels is peculiarly susceptible of inflammation. . . . This inflammation sometimes produces an *effusion of coagulating lymph*, by which the opposite sides of the vein are united, so as to obliterate the tube; in this manner, a great extent of the vessel is occasionally converted into a solid cord."

Again, in Mr. Travers's most valuable treatise on Inflammation, the existing theory is summed up in the following words:—"The false membrane, as it is called, within the visceral chambers, canals, and blood-vessels, are depositions of fibrine *secreted by the capillary vessels under inflammation.*"

¹ Tom. ii, p. 15.

Finally, in a very able article lately published in the *Cyclopædia of Anatomy and Physiology*, similar views are maintained. In the face of so much traditional authority, no small degree of responsibility is involved in stating an opinion at variance with that which has hitherto been maintained upon the subject; nor should I venture to do so had I not direct observation and experiment to appeal to.

In the year 1848 I was first led to suspect the correctness of the current explanation of the pathological appearances observed in cases of phlebitis, by noticing that no irritation or inflammation occurred (in cases where it might have been expected) if the blood were prevented from stagnating in the vessels. An animal, for instance, had some pus injected into its brachial vein, and was killed on the third day. The vitiated blood had, at the time of the experiment, been prevented from lodging in the vessel by mechanical pressure in the course of the circulation. On examining the vein after death, its lining membrane was found of its natural smooth, polished, and lubricated appearance. The opening that had been made in the experiment was filled by some brownish granular matter, and no other local morbid appearance presented itself. About the same time a case occurred where a man had received a spike wound at the back of the head, which penetrated into the lateral sinus. This patient died of repeated hæmorrhage, several days after the accident. Although different styptics had been, during his life, introduced to the bottom of the wound, yet was there no inflammation of the vein produced. The lining membrane presented its natural polished surface. In another case, a patient died of symptoms of poisoned blood, after the operation for hæmorrhoids by ligature. On examining the parts, a vein was found terminating upon the wound produced by the operation, but its lining membrane presented nothing remarkable.

In these instances, no coagulum had formed in the wounded vessels. The blood, which was found fluid after death, had flowed through

them in its natural course; and it appeared to me probable that, where coagulation of the blood did not take place, lymph was not so readily produced upon the lining membrane of veins as was generally believed.

In pursuing this subject, it was found that even a small quantity of purulent matter introduced into a vein would determine the coagulation of the blood which it contained, if not prevented by mechanical interference. The examination of such cases afforded the strongest contrast to those above mentioned. Large fibrinous clots were found obliterating the cavities of the veins, the coats of which presented the well-known marks of having been acutely inflamed. These fibrinous plugs were in some parts composed of blood, which, in becoming firm, had moulded itself to the shape of the vessels; but in other parts the fibrin was entirely deprived of its colouring matter, and adhered firmly to the sides of the vein.

The cellular membrane around the veins was found in these cases loaded with serum, lymph, and pus, the results of inflammation which had evidently been excited by the morbid matter detained in them by the vitiated and coagulated blood.

In examining the specimens contained in the different museums of London, it will be difficult to find an instance where lymph has been deposited upon the lining membrane of a vein, and where the blood has not coagulated in the vessel. In many cases (and I may instance particularly some of Dr. Lee's beautiful preparations in the museum of St. George's Hospital) the same vein will be seen inflamed where a coagulum has adhered to it, but presenting its natural smooth and polished surface where this has not been the case. On finding, therefore, fibrin adhering to the lining membrane of veins only when coagulation of the blood had taken place, a doubt was raised whence this fibrin was derived; and it became a point of much interest to endeavour to determine whether it was really the product of inflam-

mation, or whether it might not be deposited directly from the blood by a modified process of coagulation.

The results obtained by M. Gendrin above referred to, which have been so generally received, would appear directly to support the former theory, and, if made with sufficient care, must have finally determined the question. But from the description he has left, a source of fallacy appears not to have been guarded against in his experiments. It is not stated that any means were used to prevent hæmorrhage into the cavity of the vessel between the two ligatures. Such hæmorrhage might occur after the operation, either from the divided vasa vasorum in the case of an artery, or from some collateral branch, or from the vasa vasorum which open into its cavity, in the case of a vein. The observations which I had made led me to suspect that the results which M. Gendrin had obtained depended upon this cause, and that the fibrin had been deposited from blood which had gained admission to the vessels after the ligatures had been applied. I therefore determined to repeat M. Gendrin's experiment, and to observe whether, if the blood were carefully excluded from the cavity of the vein, lymph would still be effused upon its lining membrane.

By the kindness and liberality of Mr. Mayer, veterinary surgeon, every convenience and assistance were afforded me for performing the experiment; and the results obtained it is my principal object now to describe. The left jugular vein of a donkey was exposed, and two ligatures were placed upon it at an interval of something less than four inches. The vein was open for about an inch, near the centre of the exposed portion, and all the blood which it contained was carefully removed. The cavity of the vessel included between the two ligatures was now filled with cotton wadding. This was introduced piece by piece, and was pressed tolerably firmly towards the lower or sternal extremity as far as the ligature. Some of the cotton wadding was also introduced, but in less quantity, towards the upper

ligature. The vessel was then carefully closed, its divided edges being sewn together with a needle and thread. Finally, the lower or sternal ligature was removed, and the wound in the integuments closed by a number of stitches. The lower ligature was removed in order to leave the circulation in the outer coats of the vessel as free as possible, the plug of cotton wadding being deemed sufficient to prevent any regurgitation of blood into its cavity. Immediately after the completion of this operation, a small portion of the cotton wadding was carefully introduced into the peritoneal cavity, and the wound made in the abdominal parietes closed by suture.

The means were thus afforded of testing the difference which would be produced by the irritation of cotton wadding, in contact with the peritoneum and in the cavity of the vein, and of observing whether these parts were really analogous in their morbid actions. The animal was killed at the expiration of forty-four hours. On opening the abdomen, the peritoneal cavity was found to contain a considerable quantity of serum, and the peritoneum itself was much injected in different parts. The piece of wadding was found completely enveloped in a thick coating of lymph. The omentum, and a portion of the colon with which it was in contact, were injected to a high degree, and the latter especially presented a very large number of spots of a bright red colour. On examining the neck, the parts about the lower portion of the jugular vein were much swollen and infiltrated with serum. The coats of the vein were found somewhat thickened for some distance below the seat of the operation. On slitting open the vein, some loose fibrin of a greyish white colour occupied its cavity below the cotton wool. Portions of this could be separated with the slightest force from the lining membrane of the vein, which was then left of its natural smooth, polished, and lubricated appearance. Immediately in contact with the wadding in this situation were some very small coagula of blood. These imperceptibly

lost their colour, and faded into the appearance of the lymph with which they were, in substance, evidently united. Between the upper ligature and the head, the vein was of its natural appearance. The blood which it contained was fluid, with the exception of a loose unattached coagulum which floated in it. The point at which the upper ligature had been applied was thickened, and the circumference of the vein was here marked by an opaque white ring, about a line and a half in breadth.

The part of the vein included between the two ligatures is that to which I wish particularly to direct attention. The lining membrane here was of rather a deeper colour than natural, *but in no point did it present any trace of effused lymph*. The results of the irritation here afforded the most marked contrast to those produced by similar means in the peritoneal cavity. The whole of the lining membrane of this portion of the vein presented a smooth and polished surface, and the valves which it contained were not perceptibly thickened.

The point at which the effusion of decolorised fibrin, observed in the sternal portion of the vein, terminated, was defined with the greatest exactness. This was exactly where the lower of the two ligatures had been applied.

On removing the vein from its bed, it was observed that suppuration had distinctly taken place in some circumscribed portions of the surrounding cellular tissue.

The principal conclusion to be drawn from the preceding experiment and observations is, that the analogy which has been supposed to exist between the lining membrane of blood-vessels and the closed serous cavities of the body cannot be maintained, with regard to their morbid processes; and consequently that the mode of treating inflamed veins which has been based upon the supposed resemblance is not founded upon sound physiological principles.

Another point of secondary importance, but by no means devoid of

interest, is the power which the blood is shown to possess of separating directly from itself a fibro-albuminous element, without the intervention of any membrane and independent of any inflamed surface. The true pathology, and consequently the rational treatment, of obstructed veins cannot, I apprehend, be arrived at, without considering the proximate cause of the changes observed upon *post-mortem* inspections in the contents of the vessels and in the surrounding parts. That violent irritation is often produced in such cases, the amount of pain, swelling, and effusion abundantly testify. But in what part are the effects of this irritation first apparent? Not in the lining membrane of the vein, but in the surrounding areolar tissue. In the experiment above related, the internal coat of the vein was scarcely changed in appearance; the outer coverings were slightly thickened, but the surrounding cellular membrane had actually suppurated. Here, then, was the seat of the inflammation; and for what ulterior object was it established? Evidently for the purpose of getting rid of a foreign substance lodging in the vein.

The process here observed is quite analogous to that which takes place when any vitiated secretion finds its way into the circulation, and is retained in a vein. The surrounding areolar tissue will become inflamed, loaded first with serum, and then with lymph and pus, before the coats of the vein have taken on any similar actions. The visible appearances of inflammation in either case extend *to* the lining membrane of the vein, and not *from* it.

During the time that this surrounding inflammation is being established in ordinary cases of phlebitis, still more important changes, although of a different nature, are taking place within the vein. Its contents, as I have attempted to show, almost invariably become solid before its coats are thickened, and even before the surrounding parts have begun to inflame. The proximate cause of this, it is not difficult to conceive or to illustrate by experiment. The effects produced by

the admixture of pus with blood previously referred to, evidently show a latent sensibility in the blood ever ready to be called into action for the preservation of the system. Foreign matter, which would otherwise be carried in the course of the circulation, is by this means confined to one part, and produces only a local irritation. When morbid matter is thus detained in a vein by the coagulation of the blood, the inflammation of that vein will be much greater than if the vitiated matter could, in part or altogether, escape into the general circulation. This is quite in accordance with the wisest economy of nature,—an economy which we cannot too much admire, by which, when her intention is not frustrated, a part is sacrificed for the preservation of the whole. After diseased fluids have in this way entered into a kind of combination with the blood, further changes take place.

If the proportion of morbid matter be large, the whole coagulum will rapidly soften, and present to the naked eye the appearance of pus more or less discoloured. But if the quantity, which has become mixed with the blood, be small, the coagulum will retain its consistency and become adherent to the sides of the vessel. Under these circumstances the coagulum will adhere to one side only of the vessel, and as it contracts, the diameter of the vessel will be restored to its original size. In other cases, the outer layer of the coagulum will become adherent to the whole circumference of the vein, and the inner portions, which are always the least consistent, will become softened and broken down. A complete cylinder of fibrin may, in this way, be formed in the interior of a vein, through which (when the fluid portions of the coagulum are removed) the blood will circulate. It is worthy of remark that when plugs of fibrin are thus formed, the adjacent lining membrane of the veins is coloured in exact proportion to the quantity of colouring matter contained in the coagula. In some preparations the veins may be observed to be deeply blood-stained where in contact with the dark coloured clots, but to retain their natural

appearance where their contents are decolourised. The changes which take place in the interior of veins now mentioned, may be referred, I conceive, entirely to actions in the blood itself, so long as the lining membrane of the vessels remains entire. The adhesion of the coagulum, and the changes which it undergoes, are no way dependent upon secretion from its lining membrane.

This opinion is quite in accordance with what is known of the minute anatomy of the blood-vessels. In no case have vessels, I believe, been observed on the delicate fenestrated membrane which lines the veins either in health or disease. There would, in fact, be no object in providing a surface with blood-vessels which is already in contact with the blood. This fact alone might lead to the inference, that the results of inflammation in a vein would be different from those observed in serous membranes; and especially might it, *à priori*, induce us to believe that the deposits, under such circumstances, on the lining membranes of veins, would differ from the ordinary products of inflammation in their origin and mode of formation.

The opinion, that the material found in obstructed veins is derived directly from the blood, is further supported by the fact that where a coagulum is formed, and becomes incorporated with the coats of a vein in one part, the lining membrane of the vessel in its immediate neighbourhood may, nevertheless, present its natural shining appearance. Did the union, in such a case, depend upon lymph effused by inflammation, the alterations in appearance of the lining membrane would not be limited exactly and precisely, in the first instance, to the points of adhesion, and be found in no other part.

Again, we should naturally expect that a secretion, derived from the lining membrane of a vein, would adhere equally to every part of its circumference; but in the case we are considering this does not usually happen. Adhesion will take place upon one side only of the tube, and the lining membrane will, in other parts, present its natural appearance.

The process which here takes place is quite analogous to that which occasionally occurs when blood is effused in the serous cavities of the body, and which has been so admirably illustrated by Mr. Hewett in Vol. XXVIII of the *Medico-Chirurgical Transactions*.

When blood is effused in the arachnoid cavity, Mr. Hewett has shown that a smooth and polished layer will form upon its surface; and that this newly-formed substance will present the external characters of a serous membrane. Such adventitious layers were long supposed to be formed by lymph secreted by the serous membranes in which they were found;—a supposition which has also long been maintained with regard to similar formations in the cavities of veins. But it must be evident in either case, that if these membranes were formed by lymph the product of inflammation, they would adhere to all the surfaces with which they are in contact; whereas the greater part of their circumference is generally found smooth, polished, and lubricated.

Finally, the opinion that the material which, in the first instance, lines the cavities of obstructed veins, is derived exclusively from the blood, appears to be directly supported by the experiment which has now been recorded.

The point of the vein most irritated, but to which the access of blood has been denied, contained no deposit or secretion of any kind, although exposed to the contact of foreign matter for forty-four hours previous to death.

I have been the more careful in endeavouring to establish this point, inasmuch as the treatment of phlebitis has necessarily been influenced, in a great measure, by the ideas which have been entertained of its pathology.

Attempts have usually been made to subdue the prominent inflammatory symptoms by bleeding, either general or local, or by the administration of calomel and opium. M. Cruveilhier even ventures

to assert that every case of phlebitis may be cured by the application of a sufficient number of leeches, often enough repeated in its incipient stage. There can be no doubt that the patients thus treated often survive both the disease and the remedies; still oftener are the prominent symptoms apparently relieved. But if the view which has now been taken of the real nature of this disease be correct, what does the sudden disappearance of the local symptoms imply? Experience proves that but too often they subside in one part only to manifest themselves in another; and it not unfrequently happens that a day or two before death, the local symptoms have attracted less attention than at any other period of the disease.

How often has it appeared that an inflammation in the arm, after bleeding, has subsided only to develop itself in the opposite arm, or in one of the lower extremities, if not in some internal organ! We have here the explanation of the recorded description of cases in which it is stated that the patient was often bled, and every time with much advantage; but that, unfortunately, a day or two before death, his strength had so far given way, as to require the use of cordials.

It were wiser, in my opinion, to adopt and follow out the hint given us by the yet unimpaired powers of life, in combating this disease.

Unaided by medical assistance does the blood itself often fix the morbid matter which threatens the constitution to one point of the vascular system. Here it produces an irritation, the object of which is to expel that which is injurious. Bleeding and calomel will perhaps prevent the development of the inflammation established for this purpose; and they do so, I conceive, *by destroying that power in the blood which tends to localise the disease*. Calomel loosens newly-formed adhesions, and bleeding renders the coagulating power of the blood feeble; and under their influence, any morbid secretion retained in a vein would be likely to be translated to some other part of the system.

When this occurs, the constitution may still have power to throw off the diseased matter which has excited the irritation, and this is often done by the secretions of the bowels and liver. But in severe cases, I cannot but doubt the propriety of putting *the powers of the constitution to this test*.

The second point which I wish briefly to notice, with regard to the preceding experiment, is the similarity in the appearance of the lymph secreted from the peritonæum and the fibrin deposited from the blood. The two presented, as nearly as possible, the same colour and external aspect, but differed materially in consistence. The lymph adhered on all sides firmly to the surrounding parts, whereas the fibrin could be detached with the slightest force.

That the deposit in the vein was really fibrin, is evident from its having taken place only when the blood came in contact with the cotton wadding and the vein—from the facility with which it could be detached from the lining membrane of the vessel, which was then left of its natural appearance—and, lastly, from portions of the fibrin being continuous, and united with small coagula unchanged in colour.

It would thus appear that the blood has the power of separating from itself, independent of the intervention of a membrane, a fibro-albuminous element resembling lymph in its characters: and the observations previously made show, I think, that this is the material which lines the cavities of inflamed and obstructed veins, so long as the lining membrane remains entire. It is found sometimes in rounded masses, having more or less the shape of a coagulum of blood; at other times it is expanded into membranous layers; and there can be little doubt that occasionally it becomes softened, broken down, and discharged, either into the current of the circulation, or externally from the vein together with the pus from surrounding parts. An attempt to prevent the deposition of this fibrin on the internal coats of diseased veins, by bleeding and antiphlogistic remedies, must be as futile as it

is unphilosophical. And even could this be accomplished, it would be at the expense of the reparative processes which are taking place. It would deprive the parts of the very means used by nature for the reparation of local disease, and for the preservation of the system.

ON

PRIMARY AND SECONDARY FIBRINOUS DEPOSITS.

THE class of cases which form the subject of the present observations are those in which, in consequence of the admixture of some diseased secretion, the fibrin of the blood becomes separated from its other constituents, and deposited in some part of the circulating system.

Such deposits may be observed either in some of the larger vessels of the body or in the structure of internal organs. In the former of these situations they have often been noticed and described, but in the latter they have not, I believe, been distinguished from effusion of lymph on the one hand, and from tubercular deposits on the other.

In the following instances the disease was noticed both in the veins and in the substance of the lungs. The morbid processes which accompany the deposition of fibrin in the former of these situations, may serve to illustrate the analogous actions in the latter.

CASE. John Lawrence, aged 22, of a light complexion, and temperate habits, came under my care in the King's College Hospital on the 20th December, 1852. A short time before his admission, a large iron slab had fallen upon his right foot, and had remained there for some time before it was removed. No satisfactory account could be obtained with regard to the direction in which the force was applied; but the result was that the os calcis was forced outwards, leaving its small process attached to the internal lateral ligament of the ankle-

joint. The astragalus was left in the natural situation between the two malleoli; and maintained its relations with the scaphoid. The fibula was fractured quite low down on a level with the articulation. The interosseous ligament between the os calcis and astragalus was torn through, excepting at its outer part; a large wound on the inner side of the ankle exposed the posterior tibial artery for two or three inches. Through this opening the two inferior articulating surfaces of the astragalus could be distinctly felt; the larger, posterior, and external one being still partially covered by the displaced os calcis. There was no reason to suppose, at this time, that the ankle-joint was opened. The point of the foot was not turned inward nor outward, nor was the aspect of the sole of the foot altered in any remarkable degree.

The patient having been put under the influence of chloroform in order to allow the requisite examination to be made, it was found that the dislocation could be reduced by very moderate extension. Some small spiculæ of bone detached from the lesser process of the os calcis were at the same time removed; and as the skin around the joint was very little bruised, it was determined that an attempt should be made to save the limb. This the patient had particularly requested should, if possible, be done. There was some bleeding from the wound, which was in a great measure, but not entirely, suppressed, by tying some small branches close to the trunk of the exposed posterior tibial artery. The urine which he made in the course of the afternoon was observed to contain some blood. On the 23rd, there was still blood in the urine. He had slept indifferently, but felt comfortable.

On the 24th, the fifth day of the accident, the outer side of leg and foot had become red and swollen. An opening was here made near the ankle-joint, and a large quantity of matter discharged.

On the 1st January, he slept badly and complained of the leg being painful: he also mentioned having suffered from pains in the stomach. The pulse now began to vary much in quickness: on the 2nd of

January, it was 100; on the 3rd, 88; and on the 4th, 104. On this day, he first had rigors, and complained of feeling very thirsty. He vomited before dinner, and said that he had spit some blood in the morning.

Up to this time, the original wound presented a very favourable appearance. Its edges were covered by healthy granulation, the matter discharged appeared quite healthy, and all surrounding swelling and redness had subsided. The rigors were repeated on the 6th, 7th, and 10th of January. On the 11th, a large collection of matter was discovered over the sacrum. He had not previously complained of this part, and I was induced to examine it, only because he did not lie comfortably upon his bed. Seventeen ounces of fluid were at once evacuated from this abscess.

On the 15th, he complained of thirst, but said his foot was comfortable. There was some distress apparent in his breathing and he had some pain upon the left side. Pulse 128, feeble. He also experienced the sensation of "fits of cold" coming over him. On the following day the pulse had risen to 160, and there was increased difficulty of respiration. He died on the 17th, at 2 P.M.

On a *post-mortem* examination it was found that the ankle-joint was open on its outer side, and communicated with an abscess in this situation. The cartilages of this articulation, as well as those of the corresponding surfaces of the astragalus and the os calcis, had disappeared. The lower extremity of the fibula, which had been fractured, was firmly reunited, but one portion towards the ankle-joint was rough and carious. This point communicated with the abscess which had formed on the outside of the joint.

A considerable collection of matter existed deep in the calf of the leg, which was slightly swollen and puffy. The femoral and external iliac veins of the same side contained a considerable quantity of a white fluid. This presented itself in the form of small cream-coloured

masses of the consistence of firm mucus. Upon microscopical examination, these masses were found to consist of numerous cells, with a few blood globules entangled in a viscid substance, which was rendered still more tenacious by the addition of acetic acid. The cells were of a pretty uniform size, and their diameter about that of a pus corpuscle. They were transparent and delicately granular, with a faint but defined outline. Upon the addition of acetic acid the cells became much smaller and the outline more distinct; at the same time the viscid matter in which they were entangled assumed a highly granular appearance. Weak potash readily dissolved the mass, producing a clear, glairy, and rather viscid solution, containing numerous small granules. The lining membrane of the veins from which the white matter was taken presented its natural smooth, polished, and lubricated appearance. It had evidently had no part in producing this morbid product.

The left pleural cavity in this patient contained a large quantity of turbid serum which compressed the lung. The surface of the pleura was thickly coated with adherent lymph. The lower lobe of the corresponding lung was studded with numerous circular indurated patches. These, for the most part, presented an external circle of deep livid congestion in the condensed pulmonary tissue. Within each congested portion was a distinct, firm, circular mass of white deposit, and in the centre of this deposit was some white purulent looking fluid. This fluid, which was of a viscid consistence, resembled in its general appearance the matter taken from the veins. Upon microscopical examination, the cells which it contained had generally the same character as those previously described. They were, however, much more numerous in the fluid taken from the lung, and were here unmixed with blood globules. They also, in many instances, differed from those obtained from the veins in the change produced in them by the addition of acetic acid.

In many cases, upon the addition of the acid, one, two, or three bodies were developed in the centre of each cell. These, therefore, appeared to be real pus globules. Upon the addition of weak potash, the mass became glairy and viscid, and presented the same granular appearance as the matter, similarly treated, taken from the veins. The upper lobe of the left lung was comparatively free from disease. There were scattered through its substance a few deposits of white matter of the same nature as those above described. They were not, however, nearly so fully developed. Several of them contained no fluid in their interior, and were not surrounded by the same degree of livid congestion as those in the lower lobe.

On the right side, the disease was exclusively confined to the lower lobe of the lung. The deposits here presented exactly the same characters as those above described; the greater number of them contained fluid in their interior, but some of them, which were of smaller size than the rest, were solid throughout. A portion of this solid deposit was examined. It was of a yellowish white colour and contained numerous globules varying somewhat in size, but otherwise having the general appearance of pus globules. A few larger cells filled with granules and a quantity of fine granular matter were also observed. The addition of acetic acid caused the development of the central bodies characteristic of pus in a few instances only. The greater number of cells remained unaffected by this reagent.

The kidneys in this patient were found to be enlarged in a very remarkable degree. They were at least double the ordinary size. The cortical structure was very firm, of great depth, and much congested.

Although the principal object of the present paper is to inquire into the nature and mode of formation of the white deposits simultaneously found in some of the larger veins, and in the substance of internal organs, yet I may be allowed to make a brief allusion to the very uncommon accident in which the disease originated in this case.

Sub-astragular dislocations have been divided into complete and partial. Complete dislocation, in which the os calcis and the scaphoid are both displaced from their relations with the os calcis; and partial dislocation, in which one of these bones only is displaced.

M. Broca, who has lately read a very interesting memoir upon this subject before the Surgical Society of Paris, believes complete dislocation not to be very uncommon, although, as he says, no systematic description has yet been given of it. Partial sub-astragular dislocation, as far as regards the os calcis, M. Broca looks upon as an extremely rare disease, and, indeed, intimates his doubts as to whether such an accident can occur. He has met with three cases only upon record of dislocation of the os calcis alone: one of these is mentioned by Chelius, but is accompanied with no particulars. The second is related by M. Rognetta, but a dissection of the parts was not subsequently made; and the third is a specimen from the collection of Mr. Howship, at present in the museum of the College of Surgeons. This last preparation M. Broca could not have seen, or he would not have doubted the possibility of such a dislocation. In it the os calcis is completely dislocated from its articulations with the astragalus and carried outward. The astragalus which remains between the two malleoli retains its connexions with the scaphoid. The tibia and fibula appear not to have been injured by the accident. The external malleolus in this instance appears to have passed over the upper surface of the os calcis, as if the dislocation had been produced by a forcible rotation of the parts inward. All the cases above mentioned by M. Broca were probably instances of simple dislocation; we have not therefore, I believe, at present any data, derived from experience, to guide us with regard to the best mode of treating a compound dislocation of the os calcis. The preceding case is, as far as I know, the only one upon record, and I do not think that any satisfactory conclusion can be drawn from it with regard to the mode of treatment in similar instances.

The amount of disease in the kidney discovered after death, taken together with the very early period after the accident at which blood was observed in the urine, must render it doubtful whether the kidneys were not diseased before the occurrence of the accident, and whether therefore such disease may not have exercised an important influence on the result.

CASE II. In March 1853, a patient of Dr. Arthur Farre's was attended from the King's College Hospital in her confinement. She died fifteen days after delivery. The right leg had become swollen and painful a few days before her death. The gentleman who conducted the *post-mortem* examination did me the favour to allow me to examine the parts principally concerned. In the right femoral vein was found a mass of adherent decolorised fibrin which only partly filled the caliber of the vessel. The iliac vessels of the same side were obstructed by dark coagula of blood, in which small rounded masses of fibrin were embedded at various parts in clusters. These were quite white, firm to the touch, and had entirely lost their natural elasticity. The lining membrane of the vessels in which the coagula were contained were much blood stained but not thickened. In other parts of the body the blood was generally fluid. Many of the organs were softer than natural. The lungs, spleen, and liver especially, had lost their usual degree of consistency, and were broken down with very slight force. In the lower lobe of one lung were observed a few scattered circumscribed patches of white matter embedded in the pulmonary tissue, rendering it firmer than natural, but not surrounded by any increased vascularity or congestion. Some of these could be seen through the transparent pleura.

CASE III. On the 22nd September, 1853, I had the opportunity of examining the body of a patient who had died in King's College Hospital.

On the left leg were several scars, the result of old disease. Over the right instep was a puffy elastic swelling, which, upon being opened,

discharged a considerable quantity of discoloured matter. The surface of the upper part of the body was covered by numerous pustules situated an inch or two apart, and very much resembling small-pox pustules. They contained a turbid fluid which, when evacuated, left a small oval ulcerated cavity in the substance of the cutis.

The lungs were much congested, and condensed at their lower parts. In the upper lobes were one or two masses of a softish white deposit, not unlike common tubercle. In the lower lobes were numerous small oval indurated masses of white deposit; some of these could be very distinctly seen through the unaltered pleura, others were more deeply embedded in the substance of the lungs. Upon microscopical examination, this substance, which was here and there softened in its central portions, presented the same appearances as those described in the case of John Hallott (see p. 91). The substance of the lung was generally much congested, but not more in the immediate neighbourhood of these patches than elsewhere.

The separation of fibrin from the other portions of the blood answers many useful purposes in the processes of healthy reparation after injuries. Thus, when a blood-vessel is ruptured or divided, one important element in the restorative action is the separation of the fibrin of the blood which has stagnated in the injured vessel, and the agglutination by means of the fibrin so separated of the lacerated or divided parts. This action is well illustrated in all cases where the internal and middle coats of an artery have been divided. The material which immediately unites the divided edges will consist of decolourized fibrin. This will form a bed, in which the subsequent changes are produced that are permanently to seal the vessel.

Again, if a foreign body be introduced into the circulating system it will become covered over by fibrin, and thus separated from the fluid blood and fixed in some part of the vascular apparatus.

It appears, indeed, a general law, that wherever a solution of continuity occurs in the lining membrane of a blood-vessel, the lesion is in the first instance repaired by a deposition of fibrin, which agglutinates the divided edges; and in like manner, when a foreign body is introduced into a vessel, that a continuity of a smooth lubricated surface is preserved by the same means.

Healthy blood thus evinces a disposition to undergo a change wherever it is brought in contact with a foreign surface, whether this arise from the laceration of the coats of the vessel, or from the introduction of extraneous bodies into them. It would appear as if the free circulation of the blood could only be continued when in contact with the lubricated lining membrane of the blood-vessels, or with the adventitious substitute formed by a fibrinous deposit, as in the case of an aneurismal sac.

In the case of divided or lacerated veins the process of repair is the same as in arteries. The rough edges of the vein are glued together by fibrin which preserves the continuity of surface. If the side of a vein only be injured, as in bleeding, the circulation through the vessel is maintained. But if the whole circumference of the vessel be separated, as by direct violence, or by the division of veins in operations, or by the process of ulceration, then the divided edges of opposite sides may become glued together and the canal of the vessel obliterated. This process is not usually so well exemplified in the veins as in the arteries, because a wounded vein usually becomes collapsed, whereas an artery under similar circumstances remains distended with blood. There are cases, however, in which the veins are held open by the structures through which they pass, and here the use of the fibrin in closing the vessels may be readily demonstrated. Such instances occur in injuries of bones, in the uncontracted uterus after child-birth, in wounds of the sinuses of the brain, and of the liver.

How very important it is that the process of union in divided veins should be duly performed, is perhaps best illustrated by the results which follow when this does not take place.

CASE. The following fatal case of hæmorrhage from the umbilicus, in consequence of imperfect union of the umbilical vessels, I had an opportunity of seeing on the 28th of April, with Dr. Sayer and Mr. Willing of Hampstead, in whose practice it occurred. A fortnight previously the child had been born and appeared perfectly well developed, but on the day after its birth its skin was observed to be of a darkish yellow colour. At the expiration of eight days the funis separated, and everything appeared to be going on favourably, with the exception of the appearance of jaundice on the skin. Six days after this, hæmorrhage took place from the umbilicus. Several attempts were made to tie the bleeding vessel, and different styptics were applied, but without success. At length a ligature was retained by including a portion of the surrounding skin. This restrained the bleeding, but there was still some slight oozing from the opening. A conical portion of lint stiffened with wax was therefore introduced through the tendinous opening of the umbilicus. This for a time appeared to answer perfectly. After the lapse of a few hours, however, the bleeding recurred, but was again arrested by some cobweb placed over the pledget of lint. The next day the child died. The blood which flowed was thought by Mr. Willing to be arterial. It was very thin and did not stiffen the linen upon which it was received. It appeared to consist of serum tinged by the colouring matter of the blood.

On a *post-mortem* examination, the umbilical vein was found pervious through its whole extent. Near the umbilicus there was some thickening, caused principally by effused blood around the vein; at its opening was an extremely small but adherent coagulum. This was evidently quite inadequate to close the vessel. Within the orifice was

another very delicate, thin, filamentous coagulum, also firmly adhering to the lining membrane. In other points, the lining membrane presented nothing remarkable, and beyond the thickening above-mentioned the vein presented its natural appearance.

The left umbilical artery was pervious and contained only some fluid blood. The artery of the right side was closed near the umbilicus. The ductus venosus was quite open, and it is probable that after birth the blood from the vena porta passed through this channel, and consequently had not circulated through the liver. The gall-bladder was much contracted, and there had apparently been very little secretion of bile. The ductus arteriosus was also open.

The lungs were tinged yellow, and in the lower lobe of one side was a livid patch the size of a small almond. In this case, the power of coagulation and of separating fibrin from the blood was entirely absent. But in general it is not an absence of the power but some modification of it, to which the symptoms under consideration are to be referred.

In the healthy union of a vein so much fibrin only is deposited as will serve the purpose of uniting the divided edges, but when this action is not complete, the tendency to the separation of the fibrin from the other portions of the blood may be manifested to an extent quite disproportioned to the apparent object. The vessels leading from the seat of injury may be found, as in the preceding cases, partially filled with fibrin undergoing various changes, and yet without the real intention, namely, that of closing the injured vessel, is not accomplished. It is impossible not to perceive the similarity between this amount of "action without power" and that which is manifested in certain cases of erysipelas or of diffuse cellular inflammation. With such low kinds of inflammation, indeed, this profuse separation of fibrin in the vessels will be found to be more often associated than can be accounted for by any accidental circumstances.

This affection, unlike those which primarily affect the more solid

parts of the body, does not spread by continuity of surface. The abnormal disposition to separate into its different parts, communicated to the blood, may take a greater or less time in its development. And the separated fibrin may be deposited in any part of the vascular system. Lengthened tracts of healthy vessels may intervene between the original seat of disease and the places in which its results are manifested; or in other instances, where the effects may be traced directly from the seat of injury, smaller portions of veins will at intervals be found unaffected.

When once this morbid disposition has been communicated to the blood, it matters not in what part of the vascular system the deposit occurs, the essential characters and subsequent changes which it undergoes will be found to be strictly analogous. It may be found in the larger veins of the extremities, or in the *venæ cavæ*; in the cavities of the heart, or in the pulmonary artery; and even in some of the larger arteries of the extremities. Finally, as demonstrated in the preceding cases, it may be found in the structure of the lungs or in other organs.

The author has observed this affection in the form of numerous filamentous fibrinous shreds in the veins of the liver; and in the form of firm white deposits in the kidney and in the spleen. In the latter situation, they are generally more or less tinged by the colouring matter of the blood. Although the changes thus observed manifest themselves in all parts of the system, yet, that they originate in local actions and are in the first instance dependent upon the admixture of diseased secretions with the blood, is manifested from the great proportion of cases in which the affection can be traced in the course of the circulation from the original seat of injury. Thus, in the first instance recorded in this paper, we have an abscess found in contact with the carious portion of the fibula, a second abscess subsequently developed in the calf of the leg; the veins of the upper part of the

thigh are found filled with a viscid white matter, while those of the opposite side present nothing unusual; and, finally, deposits of similar matter, undergoing and producing the changes which have been mentioned, are found in the lungs.

The different effects produced directly upon the blood by the admixture of different diseased secretions may be illustrated by experiments upon blood recently drawn. The very dissimilar way in which the admixture takes place in these rough experiments, to that which obtains in the living body, may prevent the two cases from being considered analogous. The experiments may, however, be used as illustrations, and have the advantage of excluding various adventitious influences upon which the effects might be supposed to depend in the living body.

Some blood was drawn from a healthy horse and poured into three vessels, capable of containing three ounces each. The blood in the first vessel was allowed to remain as a standard of comparison. To that in the second vessel was added some viscid matter from an indolent tumour in a horse's neck, and to that in the third vessel was added some pus from a chronic abscess. The contents of the third vessel began to coagulate in three minutes, and the mass was firm in four. In eight minutes, the contents of the first and second vessels had become firm. The coagulum formed by the blood and pus had a much firmer outline than the contents of either of the other vessels. The blood to which the viscid matter had been added in the second vessel presented upon its surface a thick greenish-yellow semi-transparent layer. This was not observed in either of the other portions of blood. The experiment was repeated with blood drawn from a healthy donkey in foal. In three minutes, the blood and pus began to coagulate. At this time, the blood to which the viscid fluid from the horse's neck had been added was quite fluid, but had begun to separate into its different parts. In four minutes, the blood and pus had completely

coagulated. A distinct layer of yellowish semi-transparent fluid had now formed on the top of the blood to which the viscid matter had been added. This yellowish fluid might be poured off the top of the other portions of the blood which still maintained their fluidity. At the expiration of seven minutes, the blood last mentioned became solid, and presented a uniform yellowish-grey surface. This afforded a strong contrast to the appearance of the blood and pus which was dark coloured throughout, and had not parted with any of its serum. The unmixed blood at this time remained fluid without apparent alteration.

The results obtained in these experiments tend to show that while some diseased secretions have a tendency to coagulate the blood, others have a tendency to cause it to separate into its different elements. A second cause which tends directly to produce this separation, although in a minor degree, is rest. It was long ago observed by Hunter, that if blood were kept at rest in a vein previous to the operation of bleeding, that the portion of blood first drawn would the soonest separate into its different parts. This principle may have a material influence when the whole mass of the blood has become affected, in determining where such a result shall first be manifested; and also in causing the disease under consideration to extend in a direction contrary to that of the circulation. In the second of the above cases, the iliac vessels were more completely obstructed than the femoral; but in the latter, the larger deposits of decolorised fibrin were found, and it is, I think, fair to conclude that the obstruction in the former had preceded the physical change in the latter. In like manner may we explain the circumstance which has been sometimes noticed, that after amputation of a limb a collection of purulent looking fluid may be found in one of the veins of the opposite side. Any obstruction to the circulation produced by deposits of fibrin or by coagulation of blood in the vena cava would, of course, act equally upon the iliac

veins of both sides, and, through them, upon the veins of smaller diameter.

Although this disease may be described as one, in whatever part of the system it is met with, yet it may be convenient, for the sake of description, to consider the changes observed in the fibrin before and after the vitiated blood from which it is derived has passed through the heart. To these two conditions, the terms "primary" and "secondary deposits" may be applied.

PRIMARY DEPOSITS OF FIBRIN.

Three stages may be noted in this affection: first, the separation of the fibrin from the other portions of the blood, and its adhesion, slight at first, to the lining membrane of some of the larger veins. Second, the formation, in the fibrin so deposited, of cells, having more or less the appearance of pus globules; and, third, the production of irritation and inflammation in the surrounding parts.

I. In the early stages of this disease, in which alone its true nature can be recognised, the morbid process is confined to the blood itself. Neither the lining membrane of the veins, nor the surrounding parts, present any deviation from their natural condition.

II. In the second stage of the disease, we find cell-development in the interior of the separated masses of fibrin; still without any increased action in the surrounding parts, or any change in the lining membrane of the veins. This action is evidently due to some change which has passed upon the fibrin of the blood; for fibrin in its normal condition may be deposited upon, and adhere to, the lining membrane of veins for an indefinite period without any such changes being produced. This is exemplified in a preparation in my possession, for which I am indebted to Mr. Southam of Manchester. It was taken from a patient who had suffered from elephantiasis of the leg. The fibrin may be observed deposited on the lining membrane of a portion

of the saphena vein, and forming in one part a complete tube, into which a small rod of glass is introduced. No process of softening, similar to that under consideration, here took place; nor were the coats of the vein at all thickened at those parts to which the fibrin did not adhere. When cell-development does take place, as in the first and third cases above related, the central portions of the fibrin become softened down and soon assume the appearance of pus. No real pus globules can, however, at this time be discovered.

III. In the third stage of this affection the surrounding parts participate in the disease. Increased vascularity, accompanied by effusion, may be seen first in the areolar tissue around the veins in which the deposit has taken place, and here it is that true pus cells are first formed.

In a fatal case of phlebitis after venesection, the author has witnessed a circumscribed patch of well formed pus on the external surface of the cephalic vein at some distance from the original wound. In this case no appearance of suppuration could be discovered in any other part of the limb. The order in which the different tunics of a vein in such cases apparently become affected, although different from what might at first have been imagined, is strictly in accordance with that which may be observed in other parts. Whenever an irritant is applied to an extravascular structure, the reaction produced is first manifested in the surrounding tissues. Thus if a foreign body enters a joint and lodges between the cartilages, the consequent inflammation is first apparent in the skin, the areolar tissue, and the synovial membrane; or if, again, a piece of iron filing lodges in the cornea, it is in the conjunctiva and sclerotica that the symptoms of irritation are first seen.

In the latter stages of this disease, when effusion has taken place in the cellular coat of a vein, the irritation may be propagated by the extension of the effused fluid between a vessel and its sheath. Such

infiltration may readily take place, especially in the case of the larger veins, as may be observed after bleeding in horses. If, as often happens, the edges of the skin alone are brought together, the blood which escapes underneath will readily infiltrate the cellular membranes between the vessel and the surrounding parts. This I have verified by dissection. But such a mode of the extension of disease is quite different from that by which the affection under consideration originates, and quite different also from that by which it is communicated to different parts of the system.

SECONDARY FIBRINOUS DEPOSITS.

The changes observed in fibrinous deposits from vitiated blood in the structure of lungs are analogous to those observed in the interior of the larger veins. The deposits in the lungs, like those in the veins, are first found in a solid form; like them they become softened in their central portions, and like them they induce irritation and inflammation of surrounding parts. The products of the morbid actions in the two situations are also very similar, as shewn by microscopical examination. In both we may trace the fibrin gradually converted into a fluid resembling pus, and this fluid ultimately mixing with real pus globules. There is, however, one remarkable difference in the two cases, namely, that the true pus globules appear much earlier and in greater numbers in the lungs than in the veins. This fact probably finds its explanation in the nature of the part to which the separated fibrin at first adheres. In the veins it is in contact with a non-vascular surface, in which suppuration is not readily induced, and by means of which the fibrin in the vein is separated from any secretions of the surrounding parts; whereas in the tissue of the lung pus is readily produced, and mixes directly with the softened fibrin. In a single instance, in which an attempt was made to produce this disease artificially in a healthy young dog, some decomposed and fluid

fibrin was injected into the jugular vein. At the expiration of three days, the lungs when examined presented two distinct appearances. At the lower border of one lung was a patch of dark livid congestion, about two inches long and half an inch broad. In it were found, upon microscopical examination, numerous transparent and granular cells, rather smaller than pus globules, and also some larger exudation cells containing minute oil globules. The addition of acetic acid did not cause the development of the central bodies characteristic of pus in any of these cells.

In other parts of the same lung were a few round, white, semi-transparent bodies, each about the size of a rapeseed. These were firm in consistence, unyielding to the touch, and surrounded by a very faint margin of increased vascularity. Portions of two of these little bodies were removed with the scissors, and examined by Dr. Beale and myself. They were composed of cells, about the size of pus cells, and having much the same general appearance, together with larger exudation cells containing minute oil globules and granular matter. Upon the addition of acetic acid, the larger cells were very little affected, but the smaller ones in many instances presented the central bodies characteristic of pus globules.

As far as the author's observations have extended, secondary fibrinous deposits may be distinguished in their origin from ordinary secondary abscesses in presenting little, if any, surrounding congestion or increased vascularity. In the second stage they also differ in presenting in their substance a distinct layer of firm white matter, free from the colouring matter of the blood. This is situated between the pulmonary tissue, which now presents a variable degree of congestion and the more or less fluid matter found in the centre of each tumour. When first formed, fibrinous deposits much resemble in their external characters and general disposition scrofulous tubercles. They are as firm in consistence and may be seen scattered in a somewhat similar

manner through the substance of internal organs. The deposit in both cases is of a more or less oval form, in both it is developed in many parts at the same time, and in both it is attended with little, if any, change of structure in the surrounding parts.

The fibrinous differ from the strumous deposits in occupying principally, if not exclusively, the lower lobes of the lungs. They also appear to be more frequently developed towards the circumference of the lungs than deeply embedded in their substance. As the lung collapses, their situation may be sometimes indicated by a slight bulging of the pleura at the part; at other times, the white deposit may be seen through the transparent and unaltered membrane. It is in the later stages that the principal differences between fibrinous and scrofulous tubercles may be observed, and it is only by the changes which the more advanced fibrinous deposits at this time undergo, that attention is often directed to the true nature of those which have been more recently formed.

At the same time that fibrinous deposits take place within the blood-vessels, or in the structure of internal organs, extensive effusions may be often observed in the serous cavities, or in the areolar tissue of any part of the body. These effusions may consist of serum alone, or of serum mixed with lymph, or of puriform fluid. They are formed without any of the usual signs of inflammation. There is no particular pain, redness, or throbbing during life, and very little or no indication of increased vascularity after death. The effusions are generally not limited by any process of adhesive inflammation, and consequently when they occur in the cellular membrane they infiltrate the parts to a great extent, and when they are found in the serous membranes the whole of the cavity is implicated. The process by which the serum, lymph, and puriform fluid is effused in these cases, resembles more an act of transudation than of inflammation; and, as we can trace the separation of the blood into its different parts commencing in the vessels, it is easy to conceive that very little further action is necessary

in order to complete that separation in the forms in which it is found of effusions of serum, and of lymph; or, again, as we have cell-development commencing in the separated fibrin in the vessels, and the production there of a puriform fluid, it is not difficult to imagine that that product may be separated from the blood and deposited in various parts without any inflammatory action.

The process of the separation of the serum and the fibrin, and the conversion of that fibrin into a white fluid containing cells, appears the same, whether observed in the larger vessels of the body or in other parts;—whether accomplished through the intervention of a serous membrane or independent of any such means.

In the advanced stage of the disease, when the softened fibrin circulates with the blood, it is necessary to distinguish the disease from that which has been described by Professor Bennett under the name of Leucocythemia. In the latter affection, according to Professor Bennett, the blood cells are formed without their colouring matter, in consequence of some error or defect in their development; but in the disease which I am attempting to describe, the cells are formed in the separated fibrin of the blood, and have, I believe, no relation to the blood cells.

The conclusions which I would draw from the foregoing cases and observations are—

1. That the blood may, under certain circumstances, deposit from itself a fibro-albuminous element, either in some of the larger vessels of the body or in the structure of internal organs.
2. That this process is not of an inflammatory character in its origin, and may occur either with or without the intervention of a membrane.
3. That the changes in the blood which immediately precede such an action may be caused by the admixture of vitiated secretions.
4. That the deposit, when formed, is capable of undergoing various changes which issue in the formation of purulent-looking fluid, and is capable during these changes of communicating irritation to surrounding parts.

ON THE

SURGICAL TREATMENT OF HÆMORRHOIDAL TUMOURS.

IN the year 1843, Dr. Houston, surgeon to the City of Dublin Hospital, published an article in the *Dublin Journal of Medical Science*, advocating the use of nitric acid, of a specific gravity of 1500, in two kinds of hæmorrhoid affections.

The first of these is described as a sort of aneurism by anastomosis of the small vessels of the mucous membrane and submucous cellular tissue: the second as of a chronic inflammatory nature, and best illustrated by comparing it to the red, villous, tender, hæmorrhagic surface exhibited by the mucous membrane of the eyelids in old cases of chronic conjunctivitis.

“If such be a correct view of the pathology of certain internal hæmorrhoids,” observes Dr. Houston, “are such severe remedies as the knife or ligature either necessary or safe? If the seat of the baneful part of the affection lie on the surface, why not rather adopt such means as will remove that surface, *per se*, without extending beyond it, rather than such as may, on the one hand, by going to an unnecessary depth, wound vessels of such magnitude as are capable, when opened, of pouring out blood to the hazard of life; or on the other, by the severity of its operation, engender the most painful and the most dangerous symptoms? No man,” continues Dr. Houston, “ever

applies either the knife, or scissors, or even the needle and ligature, in any such patients, without more or less misgiving as to the success, or apprehension as to the result of the experiment. It is enough to read the objections to any one of these operations as detailed by the advocates of the other, and *vice versa*, to be satisfied of the little confidence reposed by the profession in either."

The direct application of the nitric acid to these vascular tumours, Dr. Houston was led to believe, combined in itself all the advantages possessed by excision or ligature, without any of their disadvantages. "The diseased surface," he says, "may be removed with little pain, and without danger; and in the cicatrisation which follows, a radical cure is effected. Nor do the good effects stop here: not only is a reparation of the worst part of the affection directly accomplished by this means, but in consequence of the bracing up of the general mucous membrane which follows the removal of the relaxed and diseased part of its surface, other varices which are present are supported and reduced in bulk. These secondary good results may be regarded as not the least important which take place."

Besides the two classes of affections abovementioned, Dr. Houston mentions that he had reason to believe that the use of the strong nitric acid might be beneficially employed for the removal of dilations of the larger veins of the bowel, sometimes connected with these vascular tumours. "In a very aggravated case of vascular tumour, complicated with large internal varices, both one and the other were removed by separate applications of the acid. The disappearance of such varices under its use may be brought about in three ways: first, by the direct action of the acid on the whole surface of the tumour, producing a slough thereof to its entire depth; secondly, by the extension of the inflammatory action to the sac of the varix, inciting there a local phlebitis, and a consequent coagulation of the blood and obliteration of the venous cavity; and thirdly, by the destruction of

the mucous membrane, simply, without obliteration of the sac—the remedy in this instance being derived from the support which the varix thereafter receives from the cicatrised and tightened membrane.”

Soon after the appearance of Dr. Houston’s valuable paper, acting upon the hint thus afforded, I was induced to try the effect of the local application of the strong nitric acid to other kinds of hæmorrhoidal tumours; and, in 1848, I published some cases and observations, showing the applicability of this mode of treatment to various kinds of hæmorrhoidal affections, and especially to such as were connected with a relaxed condition of the mucous membrane of the rectum.

From the experience which I then had, I was led to make the following observations. The benefit derived from this plan of treatment must not be expected till the small ulcers made by the caustic begin to heal. The loose folds of mucous membrane are then drawn upon, and the whole of the mucous lining is rendered more tense. Each small cicatrix, moreover, serves as a permanent point of attachment for the relaxed membrane, and consequently the inner coat (which alone descends in such cases) is retained permanently in contact with the other coverings of the bowel.

The degree of pain experienced in this operation depends in a great measure upon the way in which the nitric acid is applied. The sensibility of the thin skin around the anus is very great; and if the acid be allowed to come in contact with it, the degree of tingling pain is very considerable. If care be taken, on the other hand, to confine the application of the acid to the comparatively insensible mucous membrane, a slight uneasy sensation in the lower part of the abdomen is generally all that is complained of.

In the application of nitric acid to hæmorrhoidal tumours, the degree of irritation experienced will often depend upon the extent of surface involved in the operation. When, therefore, a considerable amount of the mucous membrane descends with the tumours, it is

desirable to select certain portions, to which the application of the acid should be confined. The action of the acid may be limited either by applying a small quantity at a time or by shielding the surrounding surface with a paste made of chalk and water.

Every portion of mucous membrane to which the acid extends should be as completely deprived of vitality as possible, since the degree of pain experienced will necessarily depend upon the remaining sensibility of the parts.

Unless these conditions are observed, the application of nitric acid, or of any other caustic, to the mucous membrane of the rectum, may prove as serious an operation as that for which it is intended as a substitute.

The nitric acid used in such cases should be the strongest that can be procured: that which is usually kept by chemists under the name of the strong nitric acid does not effectually destroy the surface to which it is applied; and when used, it therefore produces more pain than the strongest acid, and cannot moreover be so certainly relied upon to accomplish the intended purpose.

The most convenient way, perhaps, of applying nitric acid, when the tumours can be protruded, is to encircle their base with an instrument which will at the same time hold them in their situation, and make sufficient pressure to prevent hæmorrhage in case they should be disposed to bleed. If necessary, any portions of the hæmorrhoidal tumours, or of the mucous membrane, may be removed with a pair of curved scissors, and the cut surfaces immediately wiped dry, and touched with the acid. If the application of the acid be made before any bleeding has taken place, the blood in the divided vessels will become coagulated, and the vessels permanently sealed.

Care must be taken in performing this operation, when any portions of mucous membrane have to be excised, that the pressure completely command the hæmorrhage; for if any blood escape from the part it

will become mixed with the acid, and thus prevent it from effectually acting upon the surface to which it is applied. The instrument which is best adapted for restraining the hæmorrhage under these circumstances, and for holding the prolapsed tumour in position, consists of two parallel curved plates of steel, with their internal edge slightly indented. These are connected together at their extremities, and by means of a screw or spring may be made to exert the exact degree of pressure required.¹

There is a large class of cases which generally pass under the common name of piles, which have not an inflammatory origin, and are not connected with any particular enlargement of the hæmorrhoidal veins. In the instances alluded to, the inconvenience arises from portions of the relaxed mucous membrane becoming inverted and griped by the muscular fibres situated at the lower part of the rectum.

The insensibility of the mucous membrane in this complaint frequently causes the symptoms to be referred to the neighbouring parts, and therefore the disease may exist without being recognised. A patient will complain of a dull pain over the sacrum, or a heavy aching pain in the perinæum, which neither he nor his surgeon can satisfactorily account for. In the course of time, some other symptom presents itself, which draws attention to the rectum. The usual internal remedies for piles may now be administered, but these are found to produce no ultimate benefit, since the disease depends upon a mechanical cause.

In cases where the mucous membrane of the rectum has acquired an habitual disposition to "bag", it frequently happens that no medi-

¹ The instrument described by M. Jobert, in the "Gazette des Hôpitaux" of the 1st October, 1853, is a modification of the above, a description of which was published in 1848.

cine applied either generally or locally will afford relief. The loose folds of membrane, which may or may not be connected with hæmorrhoidal tumours, will descend again and again, and sometimes keep up irritation in the part for years.

Permanent relief in such cases can only be afforded by such means as tend permanently to brace the mucous membrane of the bowel. The simplest, as well as the most efficacious method of accomplishing this, is to remove one or two longitudinal folds of mucous membrane in the same way as above recommended for the removal of hæmorrhoidal tumours. It is not necessary to remove the precise portion of membrane which has been protruded. The destruction of any portion after the wound has healed will have the effect of bracing the remainder. In this, as in the operation for hæmorrhoidal tumours, it is the process of cicatrisation which cures the disease.

These observations, published in 1848, have been fully confirmed by increased experience. The application of the strong nitric acid to hæmorrhoidal tumours of all kinds has now become very general, and there appears at present some danger lest this very useful remedy should be brought into discredit by being indiscriminately applied to all cases.

No satisfactory account has, as far as I know, been hitherto published, giving a description of those cases in which the application of the nitric acid alone is required, and those in which this will not prove effectual. To attempt to supply this deficiency and to describe the mode of proceeding which I have adopted where the application of the nitric acid alone is not sufficient, are the principal objects of the present communication.

A distinction might be drawn between different kinds of hæmorrhoidal tumours founded on their different anatomical characters; but since these characteristics are themselves continually undergoing changes, such a distinction would be of little practical value.

The cases which are met with in practice may be much more simply and conveniently divided, for the purpose of treatment, into those which bleed, or are composed of a soft vascular substance; and those which do not bleed, or are formed of firmer tissue.

1. For the first of the two classes of cases, the application of the nitric acid is an excellent remedy, and in the great majority of instances no other means of surgical treatment are required. The nitric acid, when applied, penetrates the substance of the tumour, and produces its effects as described by Dr. Houston, either by causing a superficial slough or by obliterating the vessels of the part. It possesses the great advantage of giving very little pain if properly applied, of not requiring the confinement of the patient, and of being, as far as I have seen, perfectly safe.

The following cases, which I copy almost *verbatim* from my note book, afford illustrations of this mode of treatment.

CASE I. T. F., aged 42, residing in Belgrave Terrace, came under my care on the 25th of July, 1847. He stated that he had been affected with piles ten years, and had, during that period, suffered much pain in the part, of a smarting burning character. This was so severe that it occasionally kept him in bed for a month or two together. Ever since the first appearance of the piles, he had at times passed a considerable quantity of blood. He had lost, as he believed, sometimes as much as a pint a day. Two years before I saw him he had had the piles tied. This afforded him temporary benefit and he remained tolerably well for six or eight months. He had also tried, both before and after the operation, various sorts of remedies, consisting chiefly of ointments and lotions, but none of these gave him permanent relief.

He now (July 1847) suffered so much pain that he was unable to sleep at night. He experienced a constant sense of weakness about the pubis, but the pain was confined to the situation of the rectum.

There was frequent desire to pass urine, and he occasionally experienced, as he described it, a dreadful irritation all over, so as to unfit him for any exertion.

At the time that the piles were tied, he was under the care of a well known surgeon, who had devoted his attention almost exclusively to this branch of surgery. He experienced so much pain from the operation, that he expressed himself most unwilling again to subject himself to any similar treatment.

Upon examination, a cluster of internal piles could be detected, and might be seen protruding through the external orifice. Some ointment containing nitric oxide of mercury and opium was directed to be applied to the part. This gave him some relief, but still he continued to lose much blood and a considerable portion of mucous membrane occasionally protruded.

August 2nd. The strong nitric acid was applied to one of the most vascular and protruding tumours; and as this produced no inconvenience, a more free application of the acid was made a few days afterwards, so as to destroy a considerable portion of the protruded mucous membrane. After the operation, upon each occasion, the parts were replaced in their natural position. The continued loss of blood had at this time produced a visible alteration in this patient's health: he had become very pale, and languid, of a sallow hue, and constantly complained of depression and weakness. He was now directed to go into the country, and he was ordered some quinine and sulphuric acid.

Sept. 9th. His affairs obliged him to return to town. He was still suffering from depression and debility, but there had been no return of hæmorrhage since the 29th of August.

August 28th, 1849. My patient called upon me and informed me that he had continued free from hæmorrhage during the last two years. The constant uneasiness had now entirely left him, but he was subject to a slight "bearing down pain only".

April 1st, 1850. He remained well, with the exception of a slight occasional bearing down pain. He said that he now felt quite another man, and could attend without interruption to his business, which formerly he could never do for long together.

Had there been any return of the disease in this case, I have every reason to believe that I should have seen my patient again.¹

CASE II. S. D., aged 31, came under my notice in November 1850; about four months previously, she first experienced irritation and pain in the situation of the rectum after walking or riding. This was accompanied by a very uncomfortable sensation of bearing down. About a month after the first appearance of these symptoms she first had hæmorrhage from the bowel. The blood passed was fluid and came only with the motions. The quantities discharged gradually increased and soon appeared whenever she passed her motions or water. She would occasionally, at these times, lose as much as a quarter of a pint at a time. From this cause she had become extremely weak and exsanguine.

No evident reason for this hæmorrhage could be ascertained by external examination, but, on introducing the speculum into the rectum, a tumour presented itself on the right side. Immediately above this was a transverse ulcerated fissure, from which the blood was seen to spurt across the speculum in a single continued stream. This fissure was so situated that any descent of the hæmorrhoidal tumour would necessarily draw upon and separate its edges. The tumour and the fissure above it were touched with the strong nitric acid on the 14th of November.

Nov. 22nd. She had had slight hæmorrhage the second day after

¹ After the above was first published, this patient called in the summer of the year 1854, having had some return of hæmorrhage, but not sufficient to require any further surgical treatment.

the operation, but since that day she had not perceived any. She was now feeling stronger and had improved in her general appearance.

Dec. 17th. She had had no hæmorrhage since the last report, and had regained her usual health. The bowels were now quite regular, and the motions passed without pain or inconvenience. This patient was so well satisfied with the result of the operation, and with the slight amount of inconvenience which she suffered, that I cannot doubt but that I should have seen her again had there subsequently been any return of the symptoms. This and the following case seem to afford satisfactory evidence that in severe hæmorrhoidal affections the bleeding may occasionally come from a single vessel, although, doubtless, in the great majority of instances the blood is poured out from the general surface of the tumour. In either case the disease is effectually remedied by the application of the strong nitric acid.

CASE III. H. S., aged 42, was sent to me by Dr. Guy as an out-patient at King's College Hospital, on August 26th, 1852. He then stated that he had been troubled with hæmorrhoidal tumours for twelve months, and that for eight or ten months he had lost a large quantity of blood. The quantity passed he estimated at from half a pint to a pint a day. In consequence of this continued hæmorrhage, he had become completely blanched and very much out of health. Upon examination with the speculum, a vessel was seen pouring out blood *per saltem*. The strong nitric acid was applied to the part whence the bleeding proceeded, but the continued flow of blood swept the acid away as fast as it was applied, so that the operation could not be satisfactorily performed.

August 30th. He experienced a good deal of uneasiness after the application of the acid. This probably depended upon some of the acid having become mixed with the blood, and having in consequence become diffused over the mucous surface.

The bleeding had not stopped, but the blood passed was greatly

diminished in quantity. The lower part of the bowel still felt sore, and it was therefore determined not at that time to repeat the application of the nitric acid.

This was, however, done upon the 9th of September.

13th. The bleeding had now ceased.

Oct. 1st. He had had no bleeding since the last report. There was now no tendency to prolapsus, nor any other local inconvenience.

1853. April 18th. He remained quite well.

I have several times seen this patient since, and he has completely regained his health and strength. He has not, as far as I know, suffered any return of his local inconvenience up to the present time.

During the last nine or ten years, I have applied the strong nitric acid to a variety of hæmorrhoidal tumours; and, as a very general rule, I have found that it has completely and permanently prevented the recurrence of hæmorrhage; and that, where this symptom has been the only, or the principal one, which caused distress to the patient, no other remedy has been requisite to cure the disease. I have also very generally found that where other inconveniences besides hæmorrhage have been present, and the mucous membrane has not become changed in character, and hardened (as is sometimes the case, either from constant exposure, or from repeated attacks of inflammation), the application of the strong nitric acid has been alone sufficient to remove the complaint.

When nitric acid is applied to a portion of mucous membrane which has undergone no material change in structure, it permeates the tissues to a certain depth, in the same way as other fluids do when applied to an internal surface of the body. This subject may be well illustrated by the following examples.¹ If half an ounce of acidulated water is introduced into the pericardium of a dog killed twelve hours

¹ Mayo's Physiology, p. 81.

before, and warm water is injected in a continued stream through the coronary arteries, so as to flow into the right auricle of the heart, in four or five minutes the water gives unequivocal evidence of containing acid.

If a drop of ink is placed upon the peritoneum of a living dog, it sinks into it and forms a large circular stain, which at first is confined in depth to the serous membrane.

In an animal that had been killed by the wound of a Javanese poisoned arrow, the parts around the wound became of a brownish-yellow colour for the depth of several lines, and took the bitter flavour belonging to the poison.

In opening the abdomen of an animal some time after death, the parts adjoining the gall-bladder will be found to be deeply tinged with bile. In all such instances, an imbibition takes place of the fluid, which infiltrates the tissues of the part. Nitric acid, when applied to a mucous surface, acts in a similar manner; it permeates the membrane at the part touched, and partly by its direct action on the living tissue, and partly by coagulating the blood in the veins, it completely destroys its vitality. The action is under ordinary circumstances confined to the mucous membrane and the vessels which supply it. The acid does not penetrate deeper than this; and consequently, its effects being thus limited in depth, may be regulated with the greatest nicety, according to the extent of surface to which it is applied.

This operation, properly performed, I believe to be perfectly safe; for, although cases have been recorded in which very unpleasant symptoms have arisen after the application of the nitric acid, yet, never having witnessed any such, except in cases where the acid had been injudiciously employed, I am led to conclude that such symptoms may be attributed to the rules concerning the use of this remedy, already laid down, not having been observed.

11. The cases in which the use of the nitric acid alone has not proved successful, are those in which the mucous membrane has

become thickened, and the subjacent parts infiltrated with lymph, as the result of repeated attacks of inflammation; and those in which the mucous membrane from long exposure has become hardened and altered in structure. The first of these orders of cases is met with usually in the comparatively young and plethoric; the second, in patients of a languid temperament, or advanced in life. The acid, when applied in such instances, does not fairly permeate the structure of the mucous membrane; it usually removes a superficial layer only, which is soon replaced, and the diseased parts are left in much the same condition as before. These observations are illustrated by the following cases.

CASE IV. A lady, of full plethoric habit, and of a florid complexion, who had had several children, wished something to be done for some piles, which had caused her some inconvenience for a considerable time. The tumours were found to consist of firm, solid, oval masses, of a bright red colour, covered by the smooth mucous membrane near the margin of the anus. The tumours were touched with the strongest nitric acid in the usual way. At the expiration of a fortnight, they were found to be in very much the same condition as before the acid had been applied.

CASE V. A clergyman, between 70 and 80 years of age, but in good general health, complained of the constant inconvenience attending a partial prolapsus of the mucous membrane of the bowel, and a constant discharge of a brownish fluid, which discoloured his linen. This affection had lasted for several years.

Upon examination, the mucous membrane was found slightly livid, perfectly smooth upon the surface, and possessing very little sensibility. It was touched in the usual way with the strongest acid. The operation gave no particular pain. A week after, this patient again applied, and it was evident upon examination that the parts were in much the same condition as before the operation. The acid was again applied as before, and the patient allowed to return home into the

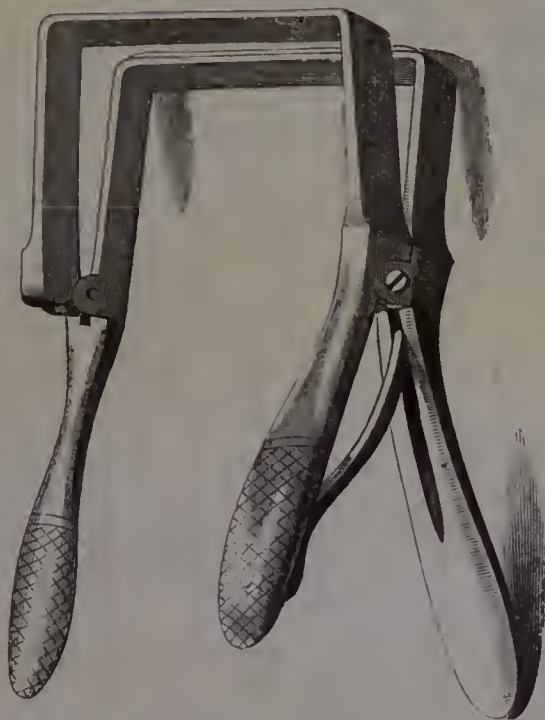
country. A few weeks after, I heard from this gentleman that his inconvenience had not been relieved, and it became a question what more effectual remedy could be had recourse to.

CASE VI. A medical man, advanced in life, consulted me on the 27th October, 1851, in consequence of the inconvenience he had long experienced from a protrusion of the mucous membrane of the bowel, accompanied by a constant discharge. The complaint had existed for many years. Upon examination, a smooth pouch of mucous membrane was found projecting on each side. The membrane was quite smooth, little vascular, and possessed little sensibility. It was touched with the strong nitric acid in the usual manner. This gentleman, who came from Wales, I had an opportunity of seeing some months afterwards. He then stated that although relieved, he was not cured, and thought that "something more might be done". The caustic was applied a second time, but still, as I subsequently learnt, with but partial success.

In such instances, the mucous membrane, by repeated attacks of inflammation, as in the fourth case, or by long exposure, as in the fifth and sixth cases, becomes altered in structure. It has no longer its villous character, and presents a perfectly smooth surface. It gradually loses its natural sensibility, becomes possessed of comparatively little vascularity, and occasionally is found covered with cuticle. The application of nitric acid under these circumstances does no harm; but I now seldom recommend it, because, for the reasons above mentioned, it does not act sufficiently upon the parts to produce a cicatrix. Its use is consequently apt to lead to disappointment, and to bring a most useful remedy into disrepute.

Whenever there is reason to believe that the application of the nitric acid alone will not act sufficiently upon the mucous membrane, the plan I have now for some time adopted is as follows:—the affected parts are first made to protrude, and then embraced by a broad forceps, made upon the plan of the instrument described by me in 1848.

The instrument consists of two parallel thin blades, with their opposed surfaces roughened, and closing by means of a spring. This may be made to exert any degree of pressure which may be required.



With this instrument the prolapsed part is seized, and such a portion of it as may be deemed expedient is cut off on the side of the "clamp" next to the operator with a curved knife made for the purpose. The cut surface is then touched with the strong nitric acid, or with the actual cautery. The parts are returned into their natural position, and the operation is completed. This plan is equally adapted for the removal of hæmorrhoidal tumours, and the excision of portions of relaxed mucous membrane, where no hæmorrhoidal tumours apparently exist. The forceps retain their hold of the base of the prolapsed part after the requisite portion is removed. The cut surface is thus

prevented from either bleeding or retracting, and it is held in a convenient position for the application of the cautery or caustic. This application is as essential a part of the operation, as securing any bleeding vessels is after an operation in any other part of the body.

It will frequently happen that the parts cannot be sufficiently protruded to be conveniently seized by the forceps which I have described. I have then performed the operation very satisfactorily in the following way:—a rectum speculum has a slide upon one side which may be removed; this is made to fit accurately into grooves on each side, so that by being withdrawn to a greater or less extent, a corresponding aperture is left in the side of the instrument. When the speculum is introduced, the slide is partially withdrawn, and the instrument moved about until the tumour, or the portion of mucous membrane required to be removed, projects into it. The slide is then closed, and the tumour is firmly held between it and the rest of the instrument; the projecting portion may then be cut off within the speculum by a long narrow knife, and the cut surface touched as before with the nitric acid, or with the actual cautery. Or, in case it should be deemed advisable to remove a longitudinal portion of the mucous membrane, the operation may be varied as follows:—the speculum, instead of being made single, is made double; that is, there is one speculum within another, so arranged that the outer one will revolve upon the inner. Each part has an oval aperture at its side: when these apertures correspond, a tumour, or portion of relaxed mucous membrane, will readily project into the speculum. When the part to be removed has thus passed through the corresponding apertures, the different portions of the instrument are made to revolve upon each other, and thus the aperture is diminished, until the condemned part is embraced between its opposite sides. Being thus firmly held, the operation is completed as above described.

All the instruments which I have mentioned, are made by Mr. Matthews of Portugal Street; and although they are very simple

now that they are finished, yet a considerable amount of time and patience have been required in order to get them adapted to their intended purpose.

CASE VII. R. H., aged 39, of sedentary habits and swarthy complexion, applied to me in the summer of 1852. He stated that he had suffered from piles for ten years. During the whole of that time, he had passed blood when he went to the water-closet, and for the last four months he had suffered much pain after each evacuation. A considerable portion of the mucous membrane projected whenever he strained, and this was always followed by an uneasy sensation, which lasted for some hours. During this time, he could find no position, as he expressed it, in which he had ease. He would occasionally lose as much as half a pint of blood at once. As the bleeding in this case, although considerable, did not form the principal feature of his complaint, and as it was probable that, even if this were arrested, the protrusion of the mucous membrane and consequent inconvenience would continue, it was resolved to remove a portion of the prolapsed membrane. For this purpose, the patient was placed under the influence of the monochloruretted chloride of ethyle,¹ by Dr. Snow, on the 24th of June. A portion of the protruding mucous membrane was removed in the manner above described, and the cut surface was touched with the strong nitric acid.

July 7th. For the last four days, the pain had entirely ceased. He said that he now felt "quite a new man". He had no inconvenience or protrusion after a motion.

July 21st. He felt quite well; had had no return of pain or bleeding, or other inconvenience.

This patient sent a friend of his to me in the early part of the autumn of 1853; and I do not doubt but that he would have come himself, had he experienced any return of his complaint.

¹ This narcotic answered perfectly its intended purpose, and was not followed by any inconvenient symptoms.

CASE VIII. E. S., aged 50, a widow, had been subject to piles, accompanied by occasional slight discharge, for twenty years. During this time, she had been habitually somewhat costive, but her general health had been good, with the exception of a feeling of weakness, caused by repeated loss of blood during the last two or three years. This patient had come under my care in the summer of 1852. The hæmorrhoidal tumours were then touched with the nitric acid; but I have preserved no notes of the particulars of the case at that time.

She again applied to me on the 5th of December, 1853. She then stated that she had derived temporary relief from her previous treatment, but that her symptoms had subsequently returned.

Upon examination, a thick fold of hypertrophied mucous membrane, covered with cuticle from long exposure, surrounded the margin of the anus. Altogether, this formed a mass the size of a pigeon's egg. Upon separating its different portions, the membrane internally was seen to be quite smooth, little vascular, and covered by a thickish muco-purulent secretion. A portion of the hypertrophied mucous membrane on each side was seized with a clamp, and removed with a sharp knife, bent laterally. The cut surfaces were then touched with the actual cautery. No narcotic was used in this instance.

Dec. 7th. She was suffering no pain, and appeared quite comfortable. There was no fever. Her circumstances required her to walk a short distance from her home, which she did without inconvenience.

Dec. 12th. There was a little local pain, accompanied by slight discharge, and some bearing down after a motion. No fever.

Dec. 28th. She had a little smarting, but had suffered no other pain since the last report.

The wounds were now all but healed, and the portions of hypertrophied mucous membrane not removed were daily diminishing in size.

Feb. 1st. She had felt no inconvenience since the last report. There were some small remains of the flaps of hypertrophied mucous

membrane, which had been left on each side of the rectum, but these had assumed a healthy appearance. The discharge had ceased, and she felt herself quite well. In this instance, the period of recovery was unusually long, owing probably to the great thickening and alteration which had taken place in the structure of the protruded membrane.

CASE 1X. J. W. came a second time under my care at King's College on the 30th of January, 1854. Six years previously, he found that he habitually lost a considerable quantity of blood when at stool, and for three or four years he had suffered from occasional prolapsus of the bowel. Soon after this symptom had appeared, he applied to me at the hospital; but there were then general considerations which induced me to recommend him not to have anything done to the piles. After this, he went to America, and returned in very good general health. The bleeding had now entirely subsided, but the inconvenience attending the prolapsus still continued.

Upon examination, an oval, red, solid tumour, irregular upon its surface, and about the size of a large strawberry, was seen projecting from between some thickened and hypertrophied folds of mucous membrane. The parts presented little sensibility to the touch, and were not disposed to bleed. Whenever the tumour descended, it caused a dull heavy pain, occasionally, as he expressed it, of a "dragging" character.

On the 1st of February, the oval tumour was seized with a clamp, and removed. The cut surface was immediately touched with the actual cautery. Portions of the hypertrophied mucous membrane on each side were treated in the same way. Upon removing the clamp, the hæmorrhage had entirely ceased. The patient being deaf, and having his face averted during the operation, was not aware that the actual cautery had been applied. He complained of the pain caused by the removal of the tumours, but was not conscious of anything else. He walked home, and was desired to keep still during the remainder of the day.

Feb. 3rd. He said he was a great deal better. He experienced slight shooting pain now and then in the part, and felt a little sore when he walked. There was no fever; he felt quite well in himself; and his appetite was "first-rate". Some folds of the thickened mucous membrane around the anus, which were not removed, had assumed a healthy appearance.

Feb. 6th. He came regularly to the hospital as an out-patient, without inconvenience. His own account of himself was, that he was "getting all right"; "there was not much the matter now". He felt a little sore.

Feb. 8th. He had suffered some pain on account of the action of purgative medicine. There was now no discharge from the bowel, and no prolapse upon going to the water-closet. The folds of thickened mucous membrane which were left had become generally reduced in size, and the whole surface was assuming its natural healthy appearance. The wounds left, in consequence of the removal of the lower folds of thickened mucous membrane, were much smaller, but not yet healed.

Feb. 10th. In his own words, the patient felt "very well indeed": he "walked more than twenty miles" on the previous day, to "Hounslow and back". There was no pain, but slight itching. Upon examination, the little wounds were not quite healed, but looking quite healthy.

This mode of operating, of which I have selected the last as recent examples, I have now put in practice a considerable number of times in the treatment of hæmorrhoidal and other kinds of tumours. It possesses the great advantage of allowing the surgeon at once to remove any part that he may wish, and of enabling him at the same time completely to control the hæmorrhage. It also furnishes him with the means with certainty of preventing the occurrence of bleeding after the operation. The difficulty of accomplishing this, as is well known, has prevented surgeons from employing excision of late years for the cure of hæmorrhoids. M. Dupuytren, who advocated excision

in these cases, on account of the pain and inconvenience attending the usual mode of operation, nevertheless confesses that hæmorrhage to a serious extent occurred in two-fifths of the cases upon which he operated, and in which no means had been taken to prevent subsequent bleeding. By the means now recommended, the great and only objection to the excision of hæmorrhoidal tumours is removed. In the cases upon which I have operated, I have found occasionally that some hæmorrhage has continued after the cut surface had been touched with the nitric acid; but in no case have I found the least inconvenience from this source where the actual cautery had been employed.

The pain of the actual cautery is in a great measure prevented by the numbness produced in the part which is held by the clamp. When chloroform is not used, the pain may further be very much relieved by freezing the tumours, or the portions of mucous membranc, before they are removed. This may conveniently be done by applying to them for a minute or two a ball of iron, which has previously been left in a mixture of pounded ice and salt.¹

The pain of freezing is with great advantage in this way substituted for that which would otherwise be produced by excision of the parts and the subsequent application of the cautery.

The advantages of this operation, as compared with others employed for the cure of hæmorrhoidal tumours, I conceive to be :—

1. That, where the application of the strong nitric acid alone is not sufficient, it is less painful than any other means equally efficacious.
2. That it is safer than the common operation now in general use.
3. That it requires less confinement, and the patient is much sooner convalescent, than after an operation with the ligature in the ordinary way.

Each of these points requires a brief consideration.

1. The pain caused by the application of the ligature to an hæmor-

¹ This is a modification of the plan proposed by Dr. James Arnott.

rhoidal tumour may be divided into that which is felt during the operation, and that which is subsequently experienced. That produced during the operation is caused in a great measure by the forcible dragging upon the part during the time the ligature is being tightened. It is very difficult during the operation for the surgeon to get his hand on the same plane as the protruded bowel. The necessary consequence is, that the ligatured portion of mucous membrane is drawn out to a level with the hands. The inconvenience produced by this "dragging" upon the intestine is altogether obviated by the operation now under consideration. The hæmorrhoid may be removed, if necessary, without even being protruded through the external opening. The pain and irritation caused by leaving the ligature upon the part to be removed is also dispensed with.

2. Although the ordinary operation for hæmorrhoidal tumours is reckoned safe, yet instances every now and then occur in which very severe and even fatal effects follow. Sir B. Brodie mentions having, in his own very large experience, had three fatal cases. I have myself had the opportunity of dissecting the parts after a fatal result in three other instances where the operation had been performed by the most able and cautious surgeons of the day. In two of these instances, secondary deposits had occurred in internal organs, and in the third there were symptoms of blood poisoning during life, and an open vein of some size was found after death, leading directly from the wound caused by the operation. When the base of a hæmorrhoidal tumour is transfixed with a needle, any large vein which it may happen to contain is necessarily liable to be wounded; and if, after this is done, each half of the tumour is included in a separate ligature, it is extremely likely that the sides of such a vessel would be held open. This circumstance, in the subsequent stages of the complaint, would, as far as it goes, directly favour the absorption into the circulation of the inflammatory products of the part. If, on the other hand, the whole of a hæmorrhoidal tumour is included in a ligature, there is a possi-

bility that it may not be completely strangulated. The outer parts of the tumour may slough, while a languid and partial circulation is continued in a conical portion in its centre. The blood which there circulates through the tissues on the verge of mortification, but which have not entirely lost their vitality, may become infected by the products of decomposition with which it comes in contact, and may thus, being again received into the circulation, become the source of general disorder in the system. This point is well illustrated by cases in which a ligature has been applied to portions of the tongue. It has been found that, as ulceration occurred in those parts directly subjected to pressure, the ligature has gradually become loosened. The circulation has then again in some measure been restored in the centre of the ligatured part, and this has been followed by symptoms of general constitutional disturbance.

After the application of a ligature to a large tumour in any part of the body, such a partial restoration of circulation may take place. There is no distinct and immediate line of demarcation drawn between the living parts and the dead; and it may be left to accidental causes to determine how much of the tumour will recover its vitality, and how much of it will perish.

That a general contamination of the blood, from some cause or other, occurred in the three cases above referred to that I had myself an opportunity of examining, I cannot doubt; and I believe that this source of danger would be entirely prevented by performing the operation in the manner which has now been described. The application of the actual cautery, while it prevents any blood flowing from the divided vessels, also prevents any vitiated fluids passing through them into the general circulation.

3. After the application of a ligature to a portion of mucous membrane, a process of ulceration is induced, and continues until the ligature separates. During this period, no process of repair can be

commenced. No two actions, as Hunter has so well said, can go on in the same part at the same time. While the part is undergoing ulceration produced by the presence of the ligature, no attempt at reparation can take place. At the time the ligature falls off, the surgeon will often be surprised, if he happens to see the part, at the size of the wound which is left. By the process of ulceration, it is rendered much larger than it would have been by the simple removal of the hæmorrhoidal tumour.

After excision of the tumour, and the application of the actual cautery, no cause of irritation remains. The operation is complete, and the process of repair at once commences. The wounds, when seen on the following days, always appear smaller than the portions of mucous membrane which have been removed. The object of the application of the cautery, it is to be remembered, is not to destroy any depth of structure, which would be in itself a somewhat prolonged and painful operation, but simply to seal the divided vessels, which, in this operation, afford the only cause for anxiety. The superficial slough, which is made for this purpose, is very soon thrown off; and a clear definite line is at once drawn between the parts destroyed or removed, and those which it is intended to leave; and there is nothing to prevent the process of cicatrisation from commencing immediately.

It is not necessary in the operation now described to include all the diseased or protruded membrane. The removal of some portions exerts its beneficial influence on that which is left. The same observations apply in this respect to the removal of a portion of mucous membrane by excision, as to its destruction by the application of the strong nitric acid. In both cases, the permanent benefit is produced during the process of cicatrisation.

I have only, in conclusion, to remark that, in the present essay, I have purposely confined my observations to the surgical treatment of hæmorrhoidal tumours.

LECTURES DELIVERED AT THE LOCK HOSPITAL.

LECTURE I.

INFECTING AND NON-INFECTING SORES.

GENTLEMEN :—We are met to-day for the first time in this hospital, by the special permission of the Board of Governors, to whom we are indebted for having placed the board-room at our disposal for the purpose of these lectures.

Among the patients admitted on the last taking-in day, are three cases of syphilitic infection, to which I wish to direct your attention. These three cases, which we have just seen, are interesting, as presenting the common and well marked characters of three very different and distinct results of syphilitic contagion. Although they illustrate the effects of a common poison, yet they offer some very marked points of contrast. They differ in their mode of origin, in the local actions to which the poison gives rise in parts not themselves primarily affected, and in the influence produced upon the general system. They differ no less in the treatment which has been pursued, and which has been based upon the consideration of the different morbid process which has been induced in each. I am anxious to enter into a full investigation of the diseased actions which have taken place in these instances, not so much on account of the features of interest which they indi-

vidually present, as because each of them may be considered as typical of a large class of cases, distinct in their essential characteristics, and presenting themselves daily in practice. I conceive that the study of such diseases is likely to be much more profitable, at least to the younger part of my audience, than the investigation of any of the more rare and uncommon forms of venereal infection.

The patients, to whose cases I am directing your attention, are all young, and bear every indication of not having before suffered from disease: we have, therefore, the advantage of studying the symptoms as they arise directly from the application of the syphilitic poison, uncomplicated by other affections.

The first case to which I will allude is that of a young married woman, E. F., who was confined seven months ago. When she had recovered, she took the place of a wet nurse; and, during her absence, her husband became diseased, and was treated for primary syphilis at this hospital. Having returned home, she found, four months ago, a sore place upon the left labium. This remained open for six weeks. At this time, she took some mercury pills, and was under treatment for three weeks; but her mouth was affected for two or three days only. During the existence of the primary disease, the inguinal glands were slightly enlarged, but not inflamed. Two months ago, an eruption appeared, which soon covered her whole body. Upon her admission into the hospital, the eruption was very fully developed: it consisted of circular elevated patches, of a deep copper colour, and desquamating upon their surface. The left eye was much injected, the pupil dilated, and the sight impaired. The cicatrix of the primary sore still presented some induration. The inguinal glands were slightly enlarged; they were not tender to the touch, rolled freely under the finger, and had remained in much the same condition since the first appearance of the primary disease.

This patient was admitted on the 27th of October, and on the 28th,

she was ordered four grains of blue pill, and half a grain of opium, three times a day; and already has she considerably improved under this treatment. The sight of the eye has returned; the pupil is now the same size as that of the opposite side; and the colour of the eruption is less strongly marked.

The traces left by the primary disease in this case show that it had its origin in a sore, surrounded by specific adhesive inflammation. From the character of the induration still remaining at the seat of the ulcer, there can be little doubt that it was of the class so well described by Hunter, and which, up to the present day, bears his name.

The inguinal glands in this case present the condition usually observed in conjunction with indurated sores; they afford the sensation of small circumscribed, oval or almond-shaped bodies, perfectly distinct from each other, unaccompanied by any redness of the skin, which moves freely over their surface. It often happens that one such gland alone can be felt. The existence of these enlarged glands tends to confirm the opinion of the nature of the disease; but they cannot in themselves be at all relied upon as a means of diagnosis. They may be enlarged in a similar manner, after any cause which gives rise to adhesive inflammation in the parts to which the lymphatics are distributed. There is, however, this peculiarity in the enlarged glands which accompany an indurated syphilitic sore; namely, that, as the adhesive inflammation which results from the syphilitic inoculation is of a chronic character, and in general lasts for a considerable time, so the corresponding affection of the glands is likely to last much longer when the affection originates from this source, than when it arises from other causes; but, during the time that it does last, an enlarged gland which accompanies common adhesive inflammation presents no characters by which it can, with any degree of certainty, be distinguished from one which, in a similar way, accompanies a

specific sore. In either case, an altered condition in the action of the inflamed parts is accompanied by a corresponding alteration in the action of the absorbent glands. This action appears to imply increased activity in the functions of the gland, corresponding with the increased activity at the seat of the adhesive inflammation; and as, in the latter case, the increased action is indicated by a thickening of the parts, so in the former is it indicated by an enlargement of the gland.

From what I have now said, it will appear that I do not regard the kind of enlargement of the lymphatic glands to which I have alluded, as in any way dependent upon the absorption of the syphilitic poison; and we have good ground for believing that no absorption of syphilitic matter by the absorbents takes place in these cases. The common effect of the introduction of syphilitic matter into a part is, as you well know, the production in that part of a peculiar and specific inflammation. This inflammation, after going through various stages, terminates within a week in the secretion of fluid more or less puriform in its character. This has been proved to be the usual course of things by experiments, by means of artificial inoculation, which have been varied in many ways, and repeated a very great number of times. If, therefore, any syphilitic matter were absorbed as such from the surface of an indurated chancre, we should reasonably expect that it would produce its specific effects, terminating in suppuration in the inguinal glands to which it is conveyed. Now, the observation of a very large number of cases enables me to say that no such suppuration takes place in the cases to which I am referring. The specific action which is induced in cases of indurated sores is not accompanied by a suppurating bubo. This proposition I believe to be true in its widest sense; but it does not of course follow that other causes may not produce a suppurating bubo in patients affected with a specific indurated sore. If the parts should be irritated by the repeated application of caustic, or if the patient should happen to

be of a scrofulous habit, then one or more inguinal glands may suppurate; but so they would in a similar proportion of cases, under the same circumstances, where no venereal infection had taken place.

There is a patient now under my care at King's College Hospital, who offers an apparent exception to the law which I have mentioned. This patient has an indurated sore upon the left side of the penis, and a suppurating bubo in the right groin. When I first saw this case, I thought that it afforded a well marked exception to the general rule; but, upon a more careful examination, a superficial ulceration presented itself beneath the prepuce on the right side, which at once accounted for the suppurating bubo in the right groin. The glands in the left groin, on the side of the indurated sore, are, in this instance, in the same condition as those in the first case above related. Whenever suppuration of an inguinal gland does occur in conjunction with an indurated sore, it will, I believe, be found to depend upon some accidental cause such as I have mentioned; and the non-occurrence of suppuration in any other cases affords very strong evidence that the absorption of the syphilitic virus, as such, is not the cause of the enlargement of glands which accompanies indurated syphilitic sores. But, as this is a somewhat novel doctrine, the evidence of direct experiment would probably be more satisfactory to some than the conclusions drawn from the observation of cases. This evidence I lately had the opportunity of affording in a case that fell under my care at King's College Hospital. A patient, thirty-two years of age, applied on the 17th of October, with a large circular and indurated ulcer on the finger. It had existed, he stated, for four months, and was considerably larger than a shilling. Some well marked syphilitic spots were appearing on his forehead and shoulders. He had never before had any similar disease, and had contracted his present affection, having exposed himself to contagion, after having burnt his finger with some quick lime. On the arm, above the elbow, and

immediately on the inside of the biceps muscle, was an enlarged gland, over which the skin could be moved freely. There was a second smaller gland in the axilla. In front of the biceps were two very small rounded masses, probably enlarged lymphatic vessels. On the 19th of October, a fine needle was introduced nearly through the largest gland on the inside of the arm. Had the gland contained any inoculable fluid, we must suppose that some of this would have been led out, and that it would have contaminated the surrounding parts. The patient was now admitted into King's College Hospital, where some of you had the opportunity of seeing him. On the 21st, two days after the puncture, no result had appeared from the experiment; and, on the 24th, there was still no result; nor has any appeared since that time.

As far as this experiment goes, it tends to prove that which was before deduced from clinical observation; viz., that the chronic enlargement of the inguinal glands, which accompanies an indurated chancre, does not depend upon the presence in those glands of any inoculable matter. The syphilitic poison cannot be traced, as such, in the class of cases which we have been considering, through the absorbent system, even to the first lymphatic gland which it would meet with in its course.

The second case to which I wish to draw your attention is that of a patient, E. T., only sixteen years of age. In this instance, the first symptom perceived was an enlargement of the inguinal glands upon the right side. Even up to the time of her admission into the hospital, she was not aware of the existence of any other disease. The enlargement of the glands soon increased, became painful and inflamed, gradually involving the surrounding parts, and terminated, within a fortnight of its first appearance, in suppuration.

Upon carefully examining this patient, an irregular ragged ulceration was discovered immediately within the orifice of the vagina.

This was painful to the touch, affording an abundant secretion, and situated upon the side corresponding to the open bubo. Upon her admission, the bubo was much inflamed, with undermined and livid edges, and afforded a copious discoloured secretion. Bark, nitric acid, and opium, were ordered; and the ulceration was dressed with a stimulating ointment.

This case affords a direct contrast to the one first mentioned. There the primary ulcer was indurated; here it is unindurated, inflamed, and ragged. There the enlargement of the inguinal glands was scarcely perceptible without a careful examination; here it forms the great feature of the complaint. In the first case, the patient was treated with mercury; here she is treated with tonics. Any one carefully considering these differences for the first time might surely say, "Why! these are two different diseases. They cannot depend upon the same morbid poison." And this view has actually been entertained by surgeons of very great eminence, and is regarded by some surgeons even of the present day as the only way of accounting for the difference observable in different cases of syphilitic infection. The difference, however, consists not in the kind of poison, but in the kind of morbid process to which that poison gives rise in different instances. In the one case, the infected part becomes callous and indurated, exuding from its surface a thin serous fluid during its early stages, and at no period furnishing a free secretion of well formed pus until it has lost its specific character—until, in fact, it is undergoing the process of repair. Up to this time, the actions in the part are very sluggish; the appearance of the surface of the wound may undergo changes in colour, depending upon the appearance or disappearance of successive crops of granulations; but the specific and peculiar induration, so characteristic in this form of disease, remains for days, and sometimes for weeks, without any very apparent alteration. Now, this infected part has to be nourished, in common with

every other part of the body. The blood is constantly circulating through it. The parts of which it is composed are acted upon in common with other living structures. Some particles, we cannot but suppose, are being removed, and are being replaced by others, in the process of nutrition. The peculiar action produced by this disease has its effect upon neighbouring parts, apparently in a state of health, as is demonstrated by the diseased actions which are set up in those parts, wherever the original disease is removed by caustic or excision. When these morbid processes are continued in an infected part for days or weeks together, we cannot be surprised that the whole system should ultimately become affected with the poison, as we have seen has happened in the first instance which I have related.

In the other case, the changes produced in the inoculated part are much more rapid; we have not the same condition of parts, upon the first appearance of the disease, for two days in succession. The ulceration rapidly increases. It is surrounded by more or less inflammation, and the parts are generally painful. The surface of the sore presents an irregular and ragged appearance, as though it had been eaten away; the parts, of which it is composed, are in a state of continual change, the surface which may be seen one day has disappeared or is disappearing the next; fresh parts occupy its place, which, in their turn, disappear in a similar manner. During the time that this action is going on at the seat of the primary disease, the glands in the groin, upon the affected side, will become painful, and the patient will complain of feeling stiff upon that side. In a day or two, the glands will be enlarged, and the pain will have increased. The skin covering them will then become red; and they now can no longer be distinguished as separate tumours, because the surrounding parts have become involved in the thickening. Within a few days from the first appearance of the swelling in the groin, the skin covering it will have assumed a deep red colour, which gradually fades into the colour

of the surrounding parts. The inflamed structures are excessively painful, and remain so until the inflammation terminates in suppuration. The pus which first forms, or, at least, which first presents itself—which first *points*, is usually derived from the cellular tissue around the affected glands. This pus possesses no specific qualities; it cannot be inoculated so as to produce a syphilitic ulcer upon another part. But there is a fluid more or less puriform in character, which is derived from the affected glands themselves; this may, with tolerable certainty, be inoculated, and it will give rise to a characteristic pustule, identical in appearance to that which would be produced by inoculating the secretion from the surface of a common syphilitic ulcer. These two fluids, so different in their actions, can only be distinguished at the time when suppuration is first established. As soon as the matter within the gland becomes discharged, it mixes with the pus from the surrounding parts, and often renders the whole capable of being inoculated, and consequently the whole surface, exposed, becomes a syphilitic ulcer.

In the process which I have now described, the absorbents play a very prominent part. The action is that of ulceration, properly so called; and we have the proof of direct experiment, that the syphilitic virus is taken up, as such, with the other materials absorbed by the lymphatics. This activity of the absorbents it is, which probably gives to the surface of the primary ulcer its peculiar, ragged, and irregular appearance. In this respect it is, that this class of cases affords so marked a contrast to that which was first noticed. In that, as far as the evidence of direct experiment went, we had reason to believe that no inoculable matter was taken up by the absorbents; and practically we find, that in those cases the buboes do not suppurate. In this we find that inoculable matter is absorbed, and that the buboes, as a rule, do suppurate. But there is another and still more important point of difference between the two classes of cases;—one so important, and of

such direct practical application, that I have reserved it for separate consideration. The stationary indurated sore will, as I have said, in the ordinary course of things, be followed by general syphilitic infection: the sore which runs rapidly into ulceration, whose surface is constantly being removed in the manner which I have mentioned, will, as a very general rule, not be followed by any constitutional disease. This law I am enabled with much confidence to state, from the observation of a great number of cases. For a long time, I have directed the attention of gentlemen to the fact, both here and at King's College Hospital, and we have not met with any cases which would lead us to suspect the correctness of the general inference. It may, I believe, be laid down as a practical guide, whenever we have the evidence afforded by a suppurating bubo that a primary sore has from the first taken on an ulcerative action, that no secondary symptoms will appear; and, therefore, as we have had this evidence in the second case, which I have read to you, I am under no apprehension that the patient's constitution is affected. I am satisfied, that as soon as her present local affections are well, that she will entirely have recovered from the effects of this disease.¹ It is superfluous, therefore, to say that any specific treatment is unnecessary in such a case.

In taking an inflamed or suppurating bubo as a test of the action which has been going on at the primary seat of disease, some little care may be requisite to distinguish the effects of the specific disease from any other accidental causes of irritation. In strumous subjects, a very slight increased action may, as I have before intimated, be the means of producing an enlargement of the inguinal glands, which may readily terminate in a kind of suppuration; and in these patients, other venereal affections (besides that which I have just described, and which I

¹ This patient was subsequently admitted into the Lock Asylum, where she remained under observation for months without any secondary disease.

may designate as "acute ulceration") may be followed by suppuration of the absorbed glands in the groin. The disease may be suspected to be scrofulous if several glands are enlarged, and especially if several are enlarged upon both sides; or if they attain a considerable size without producing much pain; or if a considerable time elapse before they break.

Again, the repeated application of caustic will sometimes give rise to an irritation, which will produce suppuration of the inguinal glands. By this means, the character of the disease may apparently be entirely changed; a sore, which in its origin was indurated, may subsequently present the characters of acute ulceration. Such an action, produced in the later stages of the affection, would not prevent the effects of the primary disease, which may have begun to develop themselves even before the caustic was applied.

Another source of error in the interpretation of symptoms in these cases, is the existence of previous disease. It will often happen that during the suppuration of a bubo, from whatever cause arising, the general health will become impaired; and, under these circumstances, it is very probable that any syphilitic symptoms which had previously existed may reappear. It has happened to me on many occasions formerly, to attribute the appearance of such symptoms to the primary disease which had immediately preceded them. A careful investigation of the history of the case will enable us to trace the occurrence of such symptoms to their real source. To these, and to similar causes, may, I believe, be traced all the apparent exceptions which present themselves in practice to the law which I have mentioned: namely, that secondary symptoms do not occur as a consequence of acute syphilitic ulceration. The truth of this fact I would insist upon, quite independent of any theoretical explanations of the reasons why it should so be. The doctrine, as it is new, will doubtless meet with many opponents; and I shall therefore collect such statistical facts as

I have, and bring them to your notice upon a future occasion. In the meantime, however, I would wish you to test the truth of the doctrine by the observation of cases as they present themselves, here or at other hospitals.

The third case to which I will refer is that of a single woman, E. A., aged 18. A month ago, a small ulcer made its appearance on the inner side of the right labium. This became rapidly larger, and has been throughout very painful, but has not at any period been accompanied by inflammation of the inguinal glands.

At the time of her admission, the sore was as large as a two shilling piece, extremely painful to the touch, and presented a sloughing surface, surrounded by considerable general thickening. This patient was ordered a grain of opium three times a day.

On the 1st of November, the surface of the ulcer had become quite clean, and she expressed herself much relieved, both with regard to her general health, and also in respect to the local pain from which she had suffered so much.

Some of the secretion from the surface of the sore was now inoculated on this patient's thigh, and the inoculation covered by a piece of plaister.

On the 3rd, the inoculation had produced no effect.

When this patient was first admitted, it appeared to me doubtful whether the sore with which she was affected had been a sloughing one from the beginning, or whether it had been an indurated chancre, which, from some accidental cause, had subsequently assumed a sloughing character. This I believe to be a very important distinction; for, if the disease was accompanied by an inflammation terminating in sloughing within the first four or five days after its communication, it is next to certain that no constitutional symptoms will follow. If, on the contrary, the disease was at first an ordinary chancre, which at the expiration of two, three, or four weeks, began

to slough from some accidental circumstance, then the sloughing, which occurred as a secondary and accidental effect, will not of course prevent the system from having previously become contaminated in the usual manner. It was, then, in order to decide this point that I inoculated this patient. It appeared probable that, if the sore had been a sloughing one from the commencement, as soon as it assumed a healthy red surface, it would no longer contain any inoculable matter. If, on the other hand, it was originally a chancre on which an accidental slough had been produced, then the specific action would still be continued in the sore, and we should have an inoculable secretion from it. The test which I have adopted in this case is not, however, free from objections. It is liable to be interfered with by disturbing causes, all of which it may be impossible to trace in any individual case, and it may therefore be used in confirmation of other means in forming our prognosis; but I should not like to trust exclusively to it. The condition of the inguinal glands in this case has afforded us very little information; what we learn from them is of a negative character. They do not present the rounded smooth feeling which is so often found in cases of indurated sores; nor have they presented any tendency to inflammation and suppuration, so very generally observed in cases of ulcerating¹ sores. The evidence derivable from them, then, as far as it goes, is in favour of this patient having been from the first affected with a sloughing sore. In that case, there will be no necessity for any specific treatment.

The syphilitic virus is very peculiar in requiring a definite time for

¹ In the second class of cases, when a part is said to ulcerate, it is not meant that there is simply a loss of substance. This is common to all sores, and may be produced in suppuration, by parts becoming dissolved or destroyed, and by other means. The term, as above used, is restricted to "ulcerative inflammation" of parts, in which, as the result of active inflammation, the surface of the sore becomes ragged and irregularly eaten away.

its development in a part; and if, after it has been inoculated, the infected part slough, the existence of the virus will cease with that of the tissues in which it was contained. This is an observation which we have constantly the opportunity of verifying. When a part upon which an artificial inoculation has been made, is made to slough, by the application of caustic, within four or five days of the infection, a simple sore alone will ordinarily result. After the separation of the slough, the surface of the wound will not furnish an inoculable matter. In like manner, after natural inoculation, if the part inoculated sloughs within the first few days, a simple ulcer alone will be left. We find in such cases that there is no suppuration of the inguinal glands, because there is no ulcerative inflammation of any infected part. There is no contamination of the system, because the virus, by means of which constitutional infection takes place, has been destroyed before that process has been accomplished.

The three cases which we have now considered, may be regarded, as I have stated, as types of three very common classes of affections, differing in their mode of origin, in their effects upon the constitution, and in the treatment which they require.

The first presented in its origin a sore surrounded by specific adhesive inflammation. The glands of the groin were in a state of slight chronic enlargement, and the constitution was affected with syphilis.

The second originated in a sore presenting the characters of acute ulceration. The glands in the groin became inflamed and suppurated. But I venture to say there will be here no constitutional affection.

The third, as far as we have been able to learn, commences as a sloughing sore, and has been accompanied by neither inflammation of the inguinal glands, nor syphilitic affection of the system. At our next meeting, I purpose to make some further remarks on the second of these three forms of disease.

LECTURE II.

LOCAL SYPHILITIC DISEASE : INFLAMMATORY BUBO.

GENTLEMEN :—In my last lecture, I brought under your notice three results of inflammation produced by the direct contact of syphilitic matter. In one of these, I mentioned that the action terminates directly in the death of the infected part ; and I pointed out that, inasmuch as the syphilitic virus requires a living nidus for the development of its specific action, the death of the part in which it is placed involves the destruction of the virus itself. The time during which the virus may remain in a part without producing any but a local disease is at least four or five days. If within this time the part be destroyed by caustic, or if it slough spontaneously, a simple ulcer only will remain. There will then be no longer any local specific action ; the inguinal glands will not participate in the disease ; and the constitution will not become affected. If, however, the sloughing is produced after the specific inflammation has been established, then it will not interfere with the usual course of the disease, but may be regarded as an accidental complication.

Of this first effect of inflammation, we have examples in cases in which parts have been purposely inoculated, and the inoculation has been destroyed by the application of some caustic. I may mention here, that, in performing this operation, it is well to use the nitric acid

or the potassa cum calce, in order to destroy the inoculated part. The action of the nitrate of silver is superficial, and there is reason to believe that it sometimes removes a superficial layer of the skin, without penetrating to the same depth as the point of the lancet.

The second form of inflammation produced by the direct contact of syphilitic matter, which I mentioned, was that in which the action terminated in acute ulceration. In this affection, the disease is not confined to the part to which the poison is applied; it may be traced in the clearest way along the absorbent vessels, generally on one side only. In any part of its course, the poison may inoculate the vessel in which it is contained, and may produce a fresh syphilitic sore, the secretion of which may again be inoculated. It usually happens, however, that the inguinal gland in which the absorbent vessels terminate is the part affected. Here alone, in the great majority of cases, does the poison exercise its influence upon the absorbent system; but that the poison actually passes, as such, through the absorbent vessels, we have abundant proof in the occasional formation of specific abscesses in the course of these vessels. This circumstance has actually occurred in the case of a patient to which I have directed your attention, as presenting a well marked instance of this disease. Between the open bubo in the groin, and the inflamed and irregularly ulcerated surface at the seat of the primary disease, a small abscess has formed. This presents tumid and irritable edges; and I cannot doubt that an inoculable pus might have been derived from it. We can then distinctly trace the entrance of the syphilitic poison into the lymphatic vessels, and from them into the absorbent glands in which these vessels terminate. The actual existence of the virus in any part of this course may be demonstrated by experiments, which have been far too often repeated to require any additional confirmation. Arrived at this point in its course, on its way apparently towards the thoracic duct, and from thence to the general circulation,

what becomes of it? A very wonderful change is here brought about. The specific virulent poison, which before was liable to contaminate every living part that it came in contact with, cannot now be traced beyond this point. The absorbent vessels between the inflamed gland and the thoracic duct do not ulcerate or suppurate; the glands into which they empty themselves do not become enlarged or inflamed. The influence of the poison is here then gone. Beyond the glands first in order, the fluids which the absorbent vessels contain are bland and harmless, incapable of being inoculated, or of infecting any part with which they come in contact. What then has become of the poison? We find it in the vessels going into the inflamed absorbent glands, but we do not find it in the vessels which proceed from those glands. In a certain number of cases, no doubt, the poison is in great measure discharged in the suppuration to which its presence gives rise. But, when we consider the exceedingly minute quantity of an animal poison that is capable of producing its specific action on a part, this explanation is not sufficient. Some of the fluid or particles which enter the gland must, in some form or other, we should think, pass through it, whether it suppurate or not. Even although we should suppose that the inflammation produced in the gland entirely obstructed its channels, still, before such obstruction could take place, some fluid would surely have time to pass; and this, if its quality remained unchanged, would be abundantly sufficient to inoculate any part with which it came in contact, or to infect the general system.

A somewhat analogous circumstance is observed in cases of cancer. The first set of glands which the absorbent vessels, coming from the seat of the disease, reach, are alone inoculated. The glands second in order, nearer the centre of the circulation, may be enlarged, but they seldom are the seat of malignant disease. Four weeks ago, a patient died in this hospital with obstinate chronic enlargement of the

skin on the right labium. My friend Dr. Druitt, who carefully examined the tumour, assures me that the substance of the skin and of the subcutaneous areolar tissue was infiltrated with cells which he could in no way distinguish from epithelial cells. Shortly before her death, the inguinal glands upon both sides suppurated; but, upon examining the body afterwards, we could find no affection at all of the glands within the abdomen. The facts presented by such cases I wish to distinguish from any theoretical explanation of them; yet, must we attempt to give a rational explanation of the cause or connexion of the circumstances which we observe. Such an explanation will lead us to further inquiries into similar actions elsewhere, which may throw some light upon our inquiries, and, perhaps, in their turn, be illustrated by them.

Independently of the essential nature of the affection, more glands will be found to be affected in malignant disease than in syphilis. This may probably be accounted for by the relative extent of parts affected in the two cases. In the first, the absorbent vessels derived from different parts of the disease may communicate the affection to several absorbent glands; in the second, the extent of surface involved is usually very limited, and the absorbent vessels leading from it are therefore also limited in number.

If we reflect upon the different ways in which foreign substances can be taken into the living body, we shall find that every such way is furnished with certain sentinels or guards which oppose the entrance of materials which, if admitted, would prove injurious. Whenever any irritating matters are applied to the skin, which might, by being absorbed, become injurious to the system, I need scarcely remind you how the delicate sense of touch informs us of what is going on, and urges us to get rid of the offending material. This is a sense common to the whole body. But the parts through which foreign matters are usually taken into the system are guarded in an especial manner.

Thus, in addition to the sense of touch, we see the mouth guarded by the sense of smell and that of taste: three out of five senses concentrated around the opening by which the food enters into the system; and one at least of the other two always ready to assist in affording information of its nature. If we trace the food onward, we find that it has to pass the double row of teeth, which are acutely sensible to the presence of any hard particles which may have become accidentally mixed with it. Should any fresh flavour be produced in the process of mastication, there are the means provided for appreciating it as the food passes through the posterior fauces. The stomach we find ready, in its turn, to reject that which is injurious; and, throughout the alimentary canal, there is an apparatus composed of a multitude of different parts, all combining to hurry on and eliminate from the system any materials which, if left, would be detrimental to it.

Finally—and this brings me back again to my subject—we have a wonderful system of minute capillary tubes (endowed with the faculty of distinguishing, so to speak, the chyle from other matters), taking up, pouring freely into the blood, that which is required for the nourishment of the system, but refusing to admit anything else. These lacteals, I need not remind you, are very similar indeed in structure, in disposition, and in function, to the absorbent vessels elsewhere. It is true that we cannot trace equally well the processes involved in the assimilation, and absorption of the different individual organs of the body, as in the analogous actions which convert the food originally into part of the living being; but, from what we do know, we have abundant evidence that the same care is taken with regard to each part as with respect to the whole; and we have reason to believe that other channels, through which foreign matters may enter the system, are guarded with the same care as that by which the common food is received.

Such facts would lead us to the *à priori* conclusion, that some means must exist to prevent the indiscriminate introduction into the circulation of any materials which might find their way into the absorbents during the active ulceration of a part; and observation demonstrates to us that such a provision really exists. The particles taken up by absorption ultimately again form part of the general circulating fluid from which they were at first derived. They have as much to be assimilated as animal matter taken fresh into the stomach. The bone, the tendon, the muscle, the nerve, which are thus removed, can no longer be recognised as such after they have been acted upon by the absorbents. All the different tissues that undergo this process form a single fluid, which ultimately becomes a part of the general circulating mass, and can then in no way be distinguished from similar products derived from the process of ordinary digestion. The action which converts foreign animal matter into blood, and that which converts parts of the living body into blood by the agency of the absorbents, are then analogous; and they agree in having the very remarkable property of converting some substances, which when introduced in any other way act as poisons upon the system, into harmless agents. It has been shown by the Abbé Fontana, that the poison of the viper, when introduced into the stomach, undergoes some change which prevents its poisonous effects upon the system. It has also been shown by two French physiologists, that the same thing happens with regard to the Woorara poison; and we have it upon no less authority than that of Sir B. Brodie, that opium may be digested in the stomachs of some animals, and that in that process its poisonous qualities are destroyed. "I have injected", says Sir B. Brodie, "a strong watery solution of opium into the stomach of a rabbit, but no poisonous effect was produced, although a similar solution, injected into the cellular membrane, occasions stupefaction and death." In like manner, as I have before intimated, we find that cancerous matter cannot be pro-

pagated from a part to the general system through the lymphatic glands; but we have evidence to prove that it may, under certain circumstances, be so propagated through the blood-vessels. It is true that the veins in the immediate neighbourhood of a cancer are very frequently blocked up with coagula, affording another instance of the preservative power above mentioned; but, when this is not the case, the cancer cells may apparently be conveyed in the course of the circulation, and infect distant parts. We have an experiment on the authority of Langenbeck, related in the *Encyclopédie Anatomique*, in which some fresh cancerous matter was injected into the veins of a dog, and cancerous tubercles were consequently developed in the animal's lungs.

In like manner, I suppose, it might be possible under certain peculiar circumstances to infect the general system with cancer through the absorbent vessels; but the fact already mentioned, that the glands first in order only are affected in consequence of local cancerous diseases, forbids the idea that this is the way in which the disease is usually conveyed to other parts.

These observations will, I hope, prepare us to consider on sound physiological principles the change that is produced in the syphilitic poison during the passage of the matters in which it is contained through the lymphatic glands. These materials are themselves undergoing a change which will fit them for becoming part of the circulating fluid, and it would seem that the poison itself undergoes a change similar to that produced in the poison of the viper, or in the Woorara poison in the stomach.

The action of the syphilitic poison must not, however, be confounded with that of other poisons which produce their effects immediately upon their application. A certain definite and peculiar action has to be gone through before the syphilitic virus can, under ordinary circumstances, enter the system. This action may vary in different

instances, but a certain interval must elapse before the poison can be absorbed so as to produce its specific effects upon the constitution. During this period it is that the ulcerative inflammation takes place in the class of cases which we are now considering.

In this process of ulceration, the freshly contaminated parts are constantly being removed. The tissues infected one day are removed the next. Now all experiments on inoculation have tended to prove that the syphilitic poison, when removed to a fresh part, has to begin afresh the morbid action peculiar to it, before it can infect that part, and through it the constitution. But in the case we are considering, the infected parts are removed as they become impregnated with the poison. The poison, before its removal, may affect other parts, but it is removed, and apparently in part carried along the absorbents before the process can be gone through which in other cases issues in syphilitic disease of the system. Thus, a sore affected with acute syphilitic ulceration presents the phenomenon of a series of abortive inoculations, each part in its turn being infected and destroyed by ulceration, before the process, which is essential to the action of the poison upon the system at large, can be accomplished. Ulceration, like mortification, destroys the vitality of the parts which it attacks, although in a more gradual manner; and as we have before seen that the syphilitic poison requires a living nidus and a certain interval of time before its local action can become developed into a constitutional disease, the process of ulceration as effectually prevents the action of the poison upon the system, as that of mortification does. There is, however, this difference, that in the latter the poison is expelled altogether from the system; in the former it is, in part at least, carried along the absorbent vessels. In these vessels we find it retaining its poisonous qualities until it enters a lymphatic gland. Here a power is manifested which prevents its introduction into the system—a power which, as I have conceived, bears some analogy to

that which is evinced by the stomach in the conversion or rejection of poisonous substances. The difference in the nature of the fluid in the lymphatic vessels, before and after it has passed the inguinal glands, is analogous to the difference in the qualities of the Woorara poison before and after it has undergone digestion in the stomach and the lacteals. In both cases do the fluid contents of the lymphatic vessels undergo a change in the glands fitting them to become a part of the circulating fluid; in both cases are poisonous matters sometimes converted or assimilated, and sometimes rejected; by vomiting in the case of the stomach, by suppuration in the case of the lymphatics.

In looking over my notes of cases which have presented themselves at this hospital within the last year or two, I have collected together and arranged in a tabular form forty-nine consecutive cases of suppurating bubo. Of these, five only are recorded as having been accompanied, or followed, by any secondary affection during the period that they remained under observation. In one of these five, there was a distinct history of previous disease, both primary and secondary. In another, the cervical glands were enlarged, and the suppuration in the groin may, therefore, probably have been of a strumous character. In two cases, the secondary eruption was tubercular:—an affection most obstinate in its nature, very liable to recur after having once disappeared, and comparatively seldom occurring as the first symptom of cutaneous disease. These, then, I regard in all probability like the first of the five cases, as the result of some previous syphilitic infection. This analysis would thus leave only one case out of forty-nine in which a suppurating bubo was apparently even followed by secondary symptoms. In this exceptional case, the secondary eruption appeared a month after the occurrence of the bubo, and may, like the others, have depended upon previous disease.

On the other hand, I have collected and tabulated in the same way thirty-one consecutive cases of secondary syphilitic eruption. In one

only of these cases does the history afford any mention of a suppurating bubo, and in that one case the history is not satisfactory upon the point. Had the notes of cases of other years been collected and tabulated in the same way I do not doubt that they would have afforded similar results. Such facts appear to establish indisputably the proposition that the chances of the infection of the system in cases of syphilis are inversely in proportion to the degree of irritation and inflammation of the absorbent vessels leading from the primary seat of disease. As this doctrine may probably appear to many to be contrary to the opinions usually entertained, I have thought it well for the satisfaction of others to collect some independent evidence on the point; and for this purpose I have used the register of the Lock Hospital, which is kept by the house surgeons as they successively come into office. I find here recorded eighty consecutive cases of suppurating bubo. Of these, eleven are recorded as having had some other syphilitic affection besides the strictly primary disease during the time that they remained under observation. In four of these cases, this affection consisted in condylomata alone. In four, of a tubercular eruption, and in three of psoriasis. It is to be remarked that here there is an entire absence of any mention of the presence of lichen, or lepra, affections of the most common occurrence, as first presenting themselves after infecting syphilitic sores. The condylomata, especially when they occur in female patients, are of such doubtful origin that they cannot be received as affording any evidence of the affection of the general system, at all events as a consequence of the primary affections with which they are associated. Omitting, therefore, the cases in which they have been mentioned as occurring without any other symptom of constitutional disease, we have seventy-six consecutive cases of suppurating bubo from all causes, and in these mention is made of secondary affections in seven only.

The presence of secondary symptoms in this small proportion of

cases may with justice be attributed to the recurrence of previous disease, and not to the primary affection which caused the suppurating bubo. This view is materially supported by the kind of eruption observed. In four out of the seven instances the eruption was tubercular, agreeing in this respect with the results obtained from my own case books. The facts presented in both collections of cases, therefore, point to the conclusion that, in the comparatively rare instances in which secondary syphilis is found in conjunction with a suppurating bubo, that it depends upon the system having been infected previous to the disease which has given rise to that suppuration. The strongest proof, however, to my own mind of the truth of this doctrine, so full of practical value, is, that having directed my attention to the subject for a considerable time, and having called the attention of the pupils to it both here and at King's College Hospital, I have not been able hitherto to find a single case in which a primary sore had clearly given rise to a suppurating bubo, and, at the same time, to constitutional syphilis. From observing, therefore, that where the absorbent vessels are most affected there is the least chance of any constitutional disease, I cannot avoid the conclusion that the absorbent vessels are not the means by which the syphilitic virus usually enters the system.

LECTURE III.

ON THE MEANS BY WHICH THE SYPHILITIC POISON ENTERS THE CONSTITUTION.

PHYSIOLOGISTS have usually recognised three modes by which absorption may take place :—

I. That by which foreign substances find their way directly into the blood through the coats of the blood vessels. This mode of absorption occurs when poisonous substances are applied to an internal vascular and membranous surface, or when they are introduced into a wound, or when they are forced through the epidermis by friction on the surface of the body.

II. The absorption of the chyle from the mucous surface of the intestines by the lacteals. When the chyle is thus absorbed, it has been supposed by many physiologists that various other substances may be taken with it into the system.

III. Absorption by the lymphatics. This is supposed to occur either in the ordinary growth and renovation of the frame, or when parts are removed and not at the same time replaced, as in ulceration.

To these three modes of absorption, by all of which extraneous substances have been supposed to enter the circulation, we may add a fourth means by which the system may be influenced by the action of some kinds of poisons :—namely, that in which a direct local effect is

produced upon the nerves of a part, and through them upon the brain (and consequently upon other organs), without the poisonous material being taken into the blood.

Examples of this mode of the action of poisons are afforded by the effects of the juice of the leaves of the aconite, and of the infusion of tobacco, as illustrated in some of Sir B. Brodie's physiological experiments.

In all those instances the action of the poison commences immediately upon its application.

But there is a very remarkable, and, to us, most interesting class of cases in which this does not happen. In these a certain interval must elapse, and a certain morbid process must be gone through before the poisons can produce their specific actions upon the general system. They are, therefore, with peculiar propriety ranked among the morbid poisons.

The deleterious materials of which these essentially consist, or the secretions in which they are contained, may be applied to the living body in any quantity, and for any length of time; and unless the process, which is peculiar to each of them respectively, be gone through, their characteristic effects will not be produced upon the constitution.

If the particular action by which these poisons individually enter the system be disturbed or interfered with—so as not to be carried out—other results may follow, but their general and specific influence will not be experienced. If the first step in the process be defective, so will be its natural consequences.

The knowledge which we thus obtain furnishes us with a most important power; for by modifying or altering the morbid process by which a poison enters the system, we may, under certain circumstances, modify or control its effects.

I purpose now to consider how far the action of the syphilitic poison upon the constitution may be thus modified or controlled, by

the kind of action which is produced when it is first applied to the living tissues of the body. For this purpose it is requisite to consider what the morbid actions really are by which the syphilitic poison gains an entrance; and what the natural processes are by which it joins itself to, and becomes as it were incorporated with, the living being.

The opinions of Hunter on the absorption of the syphilitic poison have given a bias to all subsequent reasonings upon the subject; and the theories based upon his experiments are very generally received even up to the present time. He demonstrated, as he believed, that the lymphatic vessels were the true absorbents; and he concluded from his discovery that they were the *only* absorbents in the system.

The experiments upon which his idea was founded deserve attention. Assisted by his brother and several other eminent medical men, he confined some warm milk in a portion of small intestine; and having tied the artery and vein which supplied the intestine, he saw, as he believed, the lacteals of the part presently become filled with the white milk. Upon puncturing the vein upon the distal side of the ligature, it was soon (by pressure of the finger), emptied of its blood. No white fluid could, during the continuance of the operation, be found in the vein. Upon a repetition of the experiment, in which the circulation through the mesenteric vessels was left free, the blood in the vein was carefully examined and compared with that in the neighbouring veins, but it was found not to be light coloured, nor milky, nor could any difference whatever be detected in it. It was found that even by firm pressure, which was continued until the intestine burst, the milky fluid could not be made to pass into the veins.

In another animal some thin starch, coloured with indigo, was introduced into the small intestine, and the lacteals were soon after-

wards seen of a fine blue colour. A vein in this part of the mesentery was opened, and the blood which flowed was allowed to separate into coagululum and serum. The next day the serum had not the least blueish cast.

An injecting pipe was then fixed in an artery of the mesentery, where the intestine was filled with blue starch, and all communications both in the mesentery and intestine were closed, with the exception of the vein corresponding with the artery. Warm milk was now injected until it returned by the vein. This was continued until all the blood was washed away, and the vein returned a bright white milk. The milk thus circulating through the intestine containing the blue starch, was not in any degree changed in colour.

In a third animal, some musk in warm water was confined in a portion of the intestine; after waiting a little time, some of the lacteals of the part were opened with a lancet, and some of the watery fluid which they contained was received into a small spoon. This was thought to smell strongly of musk. Some blood received into a clean spoon from one of the veins of the same part, had not the least smell of musk.

From these and similar experiments, Hunter arrived at the inference, which must have appeared one of the greatest discoveries of his age, *that the veins do not absorb in the human body*. It necessarily followed from this that the lymphatics were to be considered as the only absorbents; and this is stated by Hunter to be the fact, in his work on the venereal disease.

If the lymphatics were the only absorbents, they must of necessity have been looked upon as the only channels through which poisons could, under ordinary circumstances, enter the system; and accordingly we find Hunter asserting that the venereal matter is taken up by the absorbents of the part in which it is placed, and carried along the absorbent vessels to the common circulation.

This view, deriving as it does such an apparent confirmation, with regard to the venereal disease, from the frequent occurrence in it of inflamed lymphatic glands, has been adopted with more or less modification by almost all subsequent writers.

The accuracy of the experiments upon which Hunter based his theory have, however, justly been doubted by other physiologists; but the theory itself, as regards the syphilitic poison, has hitherto, strange to say, scarcely been questioned.

MM. Tiedemann and Gmelin, after mixing various substances, which might easily be detected, with the food of animals, not unfrequently found unequivocal traces of these substances in the venous blood and urine, whilst it was only in a very few instances that traces of them could be discovered in the chyle.

In repeating Hunter's experiments, Mayo found that half an hour after a solution of starch and indigo had been placed in the cavity of the intestine, the lacteals appeared of a clear blue colour, and those present were for a time satisfied that the indigo had been absorbed. But upon placing a sheet of white paper behind the mesentery, it was found that the blue tinge had disappeared. On removing the white paper the vessels reassumed their blue colour. It became, therefore, evident that the blue tinge was the natural colour of the empty lacteals;—that while they continued to absorb the chyle they were white, but that as soon as they were simply empty, they appeared blue.

Thus a repetition of the Hunterian experiments rather tends to prove that the function of the lacteals is limited to the absorption of chyle: and that the lymphatics are not the only absorbents, appears most conclusively demonstrated by the experiments of MM. Magendie and Ségalas. M. Ségalas varied Hunter's experiment in the following manner:—a fold of small intestine was drawn out of a wound in the belly of a dog; all the blood-vessels passing to and from it were

tied, with the exception of one artery; a vein punctured upon the mesentery allowed the blood to escape, which would otherwise have stagnated in the part. The lacteal vessels and nerves were left entire. The fold of intestine was then tied at both extremities, and an aqueous solution of the alcoholic extract of *nux vomica* was poured into it. During the hour which followed, the poison produced no symptoms. The ligatures being then removed from one of the veins, the blood was allowed to return in the natural course of its circulation. In six minutes from this time the poison took effect.

The experiments of M. Magendie illustrating the same point are well known.

The thigh of a dog was separated by M. Magendie from the body, by a division of every part, with the exception of the artery and vein; into each of these vessels a quill was introduced, and tied by two ligatures; between these ligatures the vessels were divided, and thus all communication was cut off between the body and the limb, except that which was maintained by the circulation of the blood. Two grains of the *upas tieuté* were then inserted into a wound in the foot of the separated limb. In about four minutes the poison manifested its effects upon the system.

From these and other facts, it appears certain that Hunter's idea of the lymphatics being the only absorbents is incorrect; and we are thence naturally led to the consideration of the value of the theory of the mode of absorption of the syphilitic poison, which was based upon that notion.

A careful observation of the origin of syphilitic affections will show that the diseased action to which the poison gives rise on its primary application, is not always the same. The differences observable may be traced both in the natural course of the disease, and by means of artificial inoculation.

In one class of cases as observed in practice, the secretion from

the infected part will, in the early stage of the disease, consist of a thin serous fluid more or less turbid, and the parts immediately involved will become indurated in a very peculiar and characteristic manner.

In a second class, the discharge will at the same period be more discoloured, and the parts affected will present a ragged and uneven surface. There will here be none of the peculiar and characteristic induration above mentioned.

In a third class, the secretion will from the first consist of well formed pus. The surface from which it proceeds may be even and regular; and there will be no peculiar induration, except that which may result from the granulating surface.

In a fourth class, the part infected passes at once into mortification, or into that modification of it which has been called phagedæna.

After artificial inoculation these four kinds of affection may likewise be distinguished; but, as will hereafter be more fully explained (from the fact of inoculation having been almost exclusively practised on those whose systems were already under the influence of the syphilitic poison), one or two of these forms of disease have been much more commonly observed than the others.

We may, however, distinctly observe that in some cases after inoculation, no pus is secreted before the fourth or fifth day. Up to this time the secretion is a fluid, transparent at first, but becoming gradually more turbid. As it becomes purulent, the subjacent tissues become infiltrated with plastic lymph, which gives to the touch the sensation of certain forms of cartilage.

At other times after inoculation, we find that the surface of the part will be covered by a crust of different shades of brown or yellow; and when this is removed, that a ragged irregular surface will present itself.

Again, in another class of cases the inoculation will present, as

early as the following day, a well formed pustule. The secretion will be quite white, and entirely different in character from that observed at the same period in the first above-mentioned class of cases.

Finally, we may have a phagedenic or sloughing sore as the result of inoculation, an effect often purposely produced by the application of caustic. In none of the three last descriptions of cases have we the characteristic induration observed in the first.

In immediate connexion with these different kinds of primary affection, I have to observe:—

I. Whenever in practice a sore is found from the first with a ragged and uneven surface, and is accompanied by an inflammatory bubo, that this bubo will very generally suppurate be the treatment what it may.

II. That in the experiments which have been so lavishly performed by means of inoculation (in attempting to induce that condition of the system known or imagined as a state of syphilisation, and for other purposes), the occurrence of any secondary results from those inoculations has been almost unknown.

III. As bearing directly and practically upon the theory of the absorption of the syphilitic poison, an extensive observation of cases will be found to establish the two following very important points, viz.:—that in those cases where the irritation of the lymphatic glands is the greatest, we have very seldom indeed any secondary syphilitic affection; and that in the best marked cases of general infection we as rarely find that the constitutional disease has been preceded by inflammation of the lymphatics. These latter circumstances are directly opposed to the idea of the system being contaminated through the absorbent vessels: where these are most affected, the system generally escapes; where these are not inflamed, the system is often infected.

This subject has been very imperfectly illustrated by the physiologists of the present day, and even those who have written expressly

upon syphilitic affections have generally been satisfied with recording the facts which they have observed relating to it, without attempting to explain them.

Something more satisfactory, I am inclined to believe, may be arrived at, by an attentive consideration of the earliest stages of the morbid processes which are involved in the absorption of the syphilitic poison.

The great author of this mode of investigating disease has prefaced his treatise on venereal affections with the following remarks which here find their appropriate place, and which, as I believe, have not received the amount of attention which they deserve, and have not been applied as they might have been to the illustration of our present subject. "No two actions", says Hunter, "can take place in the same constitution, nor in the same part, at one and the same time. No two different fevers can exist in the same constitution, nor two local diseases in the same part at the same time." It might appear strange to any one who had not considered the subject in its physiological relations, that such ideas should occupy so prominent a position in Hunter's work on the venereal disease, and that they should be dwelt upon in this rather than in any other of his writings. They are, nevertheless, I believe, the principles upon which much that is apparently obscure in relation to this disease may be explained. They afford a remarkable instance of that intuitive insight so peculiar to our great physiologist, by which comprehensive general ideas are appreciated in their extent and simplicity, even where their application to particular details may not have been traced.

For truth and clearness, the description of a primary syphilitic ulcer has not been excelled since Hunter's time; "a chancre", he says, "has commonly a thickened base, and although in some sores the inflammation spreads much farther, yet the specific inflammation is confined to this base." This specific action in which the arteries

throw out coagulable lymph, depends, according to the Hunterian nomenclature, upon *adhesive inflammation*. The action by which parts are removed is called the *ulcerative inflammation*; that by which pus is formed, the *suppurative inflammation*.

These three effects of inflammation Hunter regards as distinct actions, and therefore incapable of being produced in the same part at the same time. Now that which is peculiarly characteristic of the syphilitic infection of a part is a specific adhesive inflammation. This has no necessary connexion at all with either ulceration or suppuration, and indeed, according to the Hunterian doctrine, it is incompatible with either of them. Of all the kinds of inflammation to which the contact of syphilitic matter gives rise, this alone can be distinctly and certainly associated with the occurrence of secondary symptoms.

It is true that we almost always find that a part affected with syphilitic induration also suppurates, or ulcerates upon its surface; and in the more advanced stages of the disease we often see that all the parts which have been indurated pass into suppuration or ulceration. In the former case, the adhesive and suppurative inflammations affect different parts (although in close proximity to each other); in the latter, these distinct actions affect the same parts, but at different times.

An action commenced in a part will continue until the cause determining it ceases; or until it is superseded by some more powerful action. If, therefore, the ulcerative or suppurative inflammation be set up by venereal infection, it will continue until the poison has expended its influence, or until the part is attacked by mortification, or influenced by some other cause sufficiently powerful to supersede the original action. Hence it follows that if a venereal sore in its origin is affected with either the suppurative or the ulcerative inflammation, it is most unlikely subsequently to become indurated.

A most important distinction here arises between those cases which

in their origin are accompanied by specific adhesive inflammation, however limited in extent, and those which from the first suppurate, ulcerate, or slough. In the first class the poison will, with tolerable certainty, affect the system, unless prevented by medical treatment or the influence of some peculiarity, or some other disease. In the latter, the local affection will never, I believe, be followed by constitutional syphilis. Ulceration and suppuration, like mortification, destroy the vitality of the parts which they attack, although in a more gradual manner, and as the syphilitic virus requires a living nidus and a certain given space of time for its development, it is destroyed in these actions before it becomes, in the process of growth, taken into the system.

Thus practically we may say, that if a suspicious sore is from the first affected with ulcerative inflammation, or if from the first there be a free secretion of well formed pus, or if at the same period it should slough either naturally or from medical applications, the existence of the syphilitic virus will cease with that of the parts which it has infected. The disease, as far as its specific characters are concerned, will be a local one.

From what has already been said, it may be inferred that ulcerative inflammation is as incompatible in the same part at the same time with suppurative inflammation as it is with adhesive inflammation; and, in perfect accordance with this, we find practically that when an infected sore suppurates very freely from the first, or sloughs, that there is seldom any affection of the lymphatic system. But that, on the other hand, when ulcerative inflammation is early established, characterised by the ragged and uneven surface of the sore, the absorbent glands become suddenly and violently inflamed.

In these cases, we may trace in the most satisfactory manner the progress of the syphilitic poison along the absorbent vessels as far as the first lymphatic gland with which it comes in contact. In any part

of this course the poison may be arrested, and may there produce a fresh syphilitic ulcer; and that the absorbent glands into which these lymphatics empty themselves may become affected, we have daily proof from the secretions of these glands being themselves inoculable. Up to this point, then, we have unequivocal evidence of the presence of the syphilitic poison, and of its power of contaminating fresh parts. Beyond this, the poison can no longer be traced. The fluids in which it was before contained now neither possess the power of irritating the vessels through which they pass, nor, when extravasated from these vessels, of infecting other structures. Here, then, some wonderful change is produced. The specific characters of the poison can no longer be detected either by its morbid effects, or by inoculation. Even Hunter noticed this circumstance. He says, "we never find the lymphatic vessels or glands that are second in order, affected". And he remarks that when the disease has been contracted from a cut upon the finger, he has seen the bubo come on a little above the bend of the arm, upon the inside of the biceps muscle. In such instances no bubo has formed in the arm-pit, the most common place for glands to be affected by absorption.

Neither observation nor experiment, then, afford any proof that the syphilitic virus is conveyed, as such, through the absorbent glands; all the direct evidence which we have points to an opposite conclusion. The particles in which the poison resides here undergo some change, become perhaps disintegrated, and in that process the existence of the poison appears to cease.

The evidence upon which it has been assumed that the syphilitic poison enters the system through the absorbent vessels must, therefore, be regarded as most inconclusive. Arrived at the first lymphatic gland which it meets, and there undergoing some change, it becomes incapable any longer of producing, either locally or constitutionally, its specific effects; and we cannot therefore admit that this is the way

in which the system becomes infected. It will doubtless be asked, if a primary syphilitic affection will give rise to a bubo which itself may be proved by inoculation to be syphilitic, how it is that this bubo does not become a fresh source of infection? How is it that the virus may not be absorbed from the parts thus affected, so as to produce a second bubo? and how is it that the poison from this source may not be received into the system by some other means? The answer to this question is twofold. Practically, neither of these circumstances occur; theoretically, the supposed difficulty is met by a consideration of the principles already laid down. During the time that the fluids impregnated with the poison are contained in the absorbent vessels, the poison can of course exercise its influence only upon those vessels. Whenever it does so, it gives rise to inflammation, which, as it depends upon ulcerative inflammation in another part, will probably here be of the same character. As soon as an absorbent vessel or gland is thus attacked, the cellular tissue around it will become also inflamed, and will suppurate. All experiments have gone to prove that the pus formed on the outside of a lymphatic vessel is different in character to the fluid derived from the gland itself. The latter is inoculable; the former not. The action by which the parts around an affected lymphatic participate in the disease is, therefore, suppurative inflammation, which we have before considered as a process not capable of communicating the syphilitic disease to the general system. As, therefore, the contaminated fluid in a lymphatic vessel cannot pass unchanged through the absorbent glands, and can find its way to the surface only through tissues in a state of suppuration, in neither case are its poisonous effects communicated to other parts. In the action by which the poison contained in an absorbent gland is eliminated by suppuration, the whole surface involved may become inoculated by the syphilitic matter; but the inflammation being in its origin of the suppurative kind, the original action is not

by this fresh inoculation altered in its character. The process, once commenced, is continued, and, during its continuance, is incompatible, as we have seen, with specific adhesive inflammation, which, according to the view now taken, is alone capable of all the kinds of inflammation, of communicating general syphilitic infection.

To these remarks I may add, that experiment and observation concur in proving that, every time that a fresh inoculation takes place in the same individual from the same original source, the effects of the poison will show themselves with less severity.

It is not intended by anything that is here stated to imply that vitiated fluids may not enter the circulation through the absorbent system, even when the morbid process which gives rise to their formation has had its origin in the venereal disease. Well marked cases from time to time present themselves, in which the lymphatic vessels, the absorbent glands, and even the thoracic duct, are found distended with puriform or sanguinolent fluid. Such diseased products poured into the circulation must necessarily have a deleterious influence upon the constitution. They may give rise occasionally to eruptions upon the skin, which may more or less resemble true syphilitic affections. These eruptions usually appear before the primary affection to which they may be attributed has subsided. They often disappear of their own accord, and do not generally recur. Many of the diseases which, from Abernethy's time to the present, have been described under the titles of "diseases resembling syphilis", "a mild form of secondary symptoms", etc., I have little doubt may be included in this class. They may depend, as I have said, upon the absorption of inflammatory products resulting from local venereal infection, but I cannot regard them as arising from the presence of the syphilitic virus itself.

The poison of the viper, or the Woorara poison, or a solution of opium, may be introduced into the stomach of some animals without

producing their poisonous effects; but it does not follow that the digestion of these substances would be followed by no disturbance in the system. In any of the cases mentioned, some disorder might arise, although not depending upon the specific effects of the poison:—in any, a like action might be induced by substances in themselves possessing no specific or poisonous qualities.

From experiments which have been now varied in a thousand ways, and most unnecessarily repeated, it has been proved beyond a doubt that the syphilitic poison may remain in contact with an abraded surface, or may be inserted beneath the cuticle, and allowed to remain there for three, four, or even five days, and that no absorption may occur. If, during this time, an inflammatory action is set up, which is incompatible with specific adhesive inflammation, no general infection will follow. If, for instance, the part is made to slough by the application of caustic, as soon as the slough separates, a simple sore alone will remain. From this, it is evident that a certain time must elapse after the application of the syphilitic poison before any absorption can take place. This requisite period of incubation it is that secures the system against infection in cases where, from the first, ulcerative or suppurative inflammation has taken place. A part, in the course of being contaminated, becomes by these processes dissolved or removed before the act of absorption can be completed. Fresh parts, which may continue to be attacked, are destroyed before they can act as the channels of infection to the constitution. Hence occasionally arise those extensive local intractable ulcerations which have received the name of serpiginous or creeping sores. These, however formidable they may be as local diseases, do not give rise to secondary syphilitic symptoms.

We have here the secret of the absence of constitutional results after artificial inoculation in the numerous experiments that have been made on syphilisation. These experiments have been extensively tried only on those whose systems were already under the influence of the poison;

and it appears to be a very general law that, in such cases, any fresh inoculations pass rapidly into suppuration, or ulceration,—processes, as I have said, incompatible with the specific and infecting kind of inflammation. Where several artificial inoculations have been performed, and these inoculations have at once suppurated, the circumstances are in many respects similar to those in which a patient would be placed if he had a suppurating bubo. Many small spots of suppuration, and one large spot, I conceive to be nearly equivalent to each other; in neither case is the poison absorbed from these secondary inoculations. This circumstance it doubtless is that has given some of our continental brethren the idea that repeated inoculation may be a preventive against future syphilitic infection.

It is, I believe, undoubtedly true that, while a syphilitic sore is undergoing ulceration or suppuration, any similar affection arising from fresh inoculation will do the same, and it is quite possible that this tendency may be kept up by repeated inoculation for an indefinite time. During this period, no fresh absorption of syphilitic poison will take place. The same immunity is afforded by a suppurating bubo during its continuance, and perhaps for a considerable time after it has healed. But, in either case, allow an interval to elapse during which this tendency to ulceration or to suppuration shall have worn itself out, and the system will again become subject to genuine syphilitic infection, and be again liable to fresh forms of secondary disease.

From all the observations which have now been made, I conclude that the idea originated by Hunter, and received by his followers, that the syphilitic poison is taken into the system by the lymphatic vessels, is, to say the least, entirely devoid of proof. The real way in which the system does become infected may, I believe, be traced in another and much more satisfactory manner.

When syphilitic inoculation takes place in a healthy person, and

the regular course of the disease is not interfered with, two distinct processes may be recognized; one, that by which the affected tissues become infiltrated with lymph; the other, by which this effused matter is removed. This latter result may be accomplished by sloughing, by ulceration, in the natural process of growth, or by different modifications of these. But, beyond the parts immediately involved in these processes, other actions are going on of a more subtle nature, and not so easily appreciated by our senses. In the absence of more positive knowledge, we may ascribe these to the molecular changes in the nutrition of the surrounding parts. That such actions are in active operation beyond the parts where any visible or sensible change has taken place, may be readily demonstrated, although we may be unable to define their exact nature. Were this not the case, we should have nothing to do in the case of a primary syphilitic sore but entirely to remove the ulcerated and indurated tissues, and the disease would, as far as the part is concerned, be at an end. Experience proves that such is very far from being the case. When a syphilitic sore is removed by excision, as may readily be done when it is situated on the extremity of the prepuce, the cut surface will in a few days take on the specific action. This I have verified even when the greatest care has been taken not to allow any of the other matter from the chancre to come into contact with the cut surface. Such an action taking place in a part apparently healthy, at some little distance from the original sore, presupposes some antecedent change in the tissues in which it originates—a change produced by the infecting poison, but not capable of being appreciated so long as the diseased action had its development in its original situation. As soon, however, as the first centre of the morbid action is removed, a similar disease is induced upon the neighbouring cut surface. The observation of such cases demonstrates the existence of a subtle morbid process beyond the parts at first sensibly affected, and necessarily producing some change in their nutrition.

It appears under these circumstances much more in accordance with that which is known to happen in the case of the absorption of other poisons, to suppose that the blood circulating through the tissues in which these morbid actions are going on is directly influenced, than to refer the symptoms to the passage of the poison primarily through the absorbent system. When the constitution becomes affected in consequence of the inoculation of the vaccine or the variolous poisons, the lymphatic glands appear certainly to perform no essential part of the process. Few indeed have thought it necessary to invoke the aid of the absorbent system to account for the action of these poisons upon the animal economy; and I believe that it is equally unnecessary in the case of the poison of syphilis.

At present, I have only considered the different kinds of inflammatory affections produced by syphilitic contagion. The existence of similar non-inflammatory modes of infection (such as the absorption of the syphilitic virus without any change of structure in the parts to which it is applied, or the occurrence of the same effect in consequence of tubercles or excrescences not having an inflammatory origin) form a subject for separate consideration.

LECTURE IV.

ON SYPHILISATION APPLIED TO MAN AND ANIMALS.

WHEN syphilitic matter is artificially inoculated with the point of a lancet, the following appearances may be observed:—Within the first twenty-four hours, the inoculated point becomes red; from the second to the third day it swells slightly, and presents the appearance of a pimple surrounded by a red areola. Between the third and the fourth day the epidermis, raised by a liquid more or less turbid, often appears as a vesicle, which at its summit presents a black point, the result of the dried blood effused from the prick of the lancet at the time of the inoculation. From the fourth to the fifth day, the morbid secretion increases, and becomes puriform. After the fifth day, the subjacent tissues become infiltrated and hardened by the effusion of plastic lymph. Finally, from the sixth day, the secretion becomes thicker, the pustule breaks, and a scab forms on the surface; when this is removed, an ulcer is left, surrounded by a hardened base, which occupies the whole thickness of the skin. The thickening terminates abruptly, and does not gradually extend itself into the surrounding parts. The edges of the ulceration are clearly defined, and partaking of the induration, often form a reddish brown rim, slightly elevated above the level of the skin.*

* Ricord, p. 89.

But in certain states of the system a similar inoculation of syphilitic matter will be followed by different local symptoms. The day following the inoculation, instead of a pimple, a pustule will be making its appearance. On the third day, and sometimes earlier, this will be fully formed, and the fluid which it contains will consist of well formed pus; when this is removed, the surface below will soon granulate, and present in every way the same appearance as that which is left after a secondary pustular eruption. There is here no peculiar induration of the base, nor of the edges of the ulceration; no appearance of a pimple upon the inoculated spot; and no corresponding interval during which the secretion consists only of turbid serum. In one case the appearances are, in their origin, those of adhesive inflammation, in the other of suppurative inflammation; and these constitute two very different classes of disease, both in respect to the local affections and their constitutional consequences.

In repeating these experiments upon inoculation on the same individual, it has been found that the first chancre produced lasts longer than the second; the second longer than the third, and so on. Hence arose the idea that, by a succession of inoculations, a point might be arrived at, after which the system would not be susceptible of any fresh syphilitic infection. To this subject I shall again return; but at present I wish to direct your attention to the fact, that out of a great number of experiments which have been tried on syphilisation, no secondary symptoms (at least from the published accounts) appear to have arisen. The plan of successive artificial inoculations has even been strenuously advocated for the cure of both primary and secondary syphilitic affections, with what success we shall hereafter see.* At

* Any one who may wish to follow the different plans which have been adopted with a view of producing syphilisation, will find an excellent account of them all, in a little work on the subject, by M. de Méric.

the same time, the idea suggested itself of trying whether the syphilitic poison might not be made to pass through the system of some animals, so that its virulence might in that action be mitigated. It was thought that, after such a modification, it might possibly be again introduced into the human system in a milder form, and it was suggested that by being inoculated in that form, it might be the means of preventing the more serious evils which arise from syphilitic infection under ordinary circumstances. It was, in fact, hoped that a modified action might mitigate or prevent the consequences of syphilitic infection, as vaccination acts with regard to small-pox.

In investigating the results of these experiments, I believe that there is as little chance of arriving at the results which have been anticipated as there was with the alchemists of old of finding the philosopher's stone. But it may nevertheless happen, as with them, that in looking for one thing, other things may (as it were accidentally) be discovered. Now, the series of experiments to which I refer afford excellent examples of the second class of cases which I have now brought under your notice; namely, those in which the inoculated part suppurates at once, and in which there is, as far as has been observed, no subsequent constitutional affection. One of the causes which determine an inoculated part at once to pass into suppuration, appears to be the fact of the system being already under the influence of the syphilitic poison. I have noticed this particularly with regard to that state of system which precedes the development of secondary symptoms; and I believe that the remark is best illustrated when the inoculation is performed upon patients during the interval which elapses between the healing of a primary indurated sore, and the appearance of a secondary eruption.

A patient, a short time ago, presented himself at King's College Hospital, with a well defined indurated cicatrix on the prepuce. As the ulceration had healed, the patient seemed to make very light of

the "little lump" that was left, and I clearly saw, from his manner, that it would be in vain to persuade him to continue a sufficiently long course of treatment; and without this I conceived he would, with tolerable certainty, have secondary symptoms. I therefore recommended him to have the indurated part removed, which was accordingly done by a clean cut with the knife, and the cut edges were brought together. As there was no sore in this case, there could be no inoculation of puriform matter; nevertheless, as I had observed to happen in similar instances, in two or three days the whole of the cut surface presented an irritable phagedenic appearance, and afforded a copious secretion of discoloured puriform fluid. Some pus, taken from this surface, and inoculated upon the patient's thigh, gave rise to a well formed pustule on the following day. There was no bubo in this case, and, as far as I know, no subsequent syphilitic eruption.

From this and other cases it has appeared to me that syphilitic inoculations suppurate much more rapidly in those whose systems are already under the influence of the disease; and that when this is the case, the inoculations are not accompanied by inflammation of the absorbent glands, and are not followed by any additional constitutional infection.

It would further appear that, where under ordinary circumstances a constitutional affection might be expected, the occurrence of a phagedenic ulceration will prevent the development of the constitutional symptoms. During the last spring, a patient was sent to me by Dr. Budd, from King's College Hospital, where he had been treated for ague. This man had a very long prepuce, with a well marked indurated chancre at the extremity. He had never, he said, had the disease before. His health was not such as admitted of the usual treatment, and I therefore determined to remove the diseased portion of the prepuce. This was done at a considerable distance from the

induration, and care was taken that none of the matter from the sore should come in contact with the cut surface. The wound appeared to heal by the first intention; but, at the end of three days, it opened again. It now presented a phagedenic surface, situated upon a thickened base, and affording a free secretion of pus. This was proved by inoculation to be syphilitic. It was some time before this ulcer healed, but it did so without any specific treatment. There was no bubo in this case, and no constitutional symptoms up to the time of his leaving the hospital, nor have any, I have reason to believe, occurred since that period. It is to be remarked, that in both the last-mentioned cases, the syphilitic action commenced afresh in apparently sound parts. This shows that the local influence of the poison extends beyond the parts apparently affected. The fresh action is not precisely of the same kind as that which caused the original ulcer. That was characterised by a peculiar and specific induration; this, by a phagedenic surface, affording a free purulent secretion. The great point of interest in these cases is, that the parts not directly inoculated, and at some little distance from the apparent seat of disease, should, under inflammation arising from an accidental cause, produce a secretion capable of being inoculated. This clearly shows that the syphilitic action had extended beyond the limits of the apparent local disease; and yet, after the occurrence of the subsequent suppurating phagedenic sore, no constitutional symptoms appeared. Some further explanation of these points, which have hitherto scarcely been investigated, will present themselves, if we review some of the cases and experiments which have been recorded in order to illustrate the subject of syphilisation.

Syphilitic infection of the system appears, as I have said, to modify the action produced by fresh syphilitic inoculation; and, therefore, as for very obvious reasons few have ventured to inoculate patients who were not previously infected, we have not perhaps had the oppor-

tunity of fully observing what the effects of syphilitic poison are when *first* artificially introduced into the human system. It has been attempted to supply this deficiency by inoculating animals; but they are found so little susceptible of the syphilitic poison in any form, that the information gained from such observations must be received with much caution as illustrative of any similar actions on human beings. Still there are some very interesting and instructive details furnished to us in this way.

Although many attempts had previously been made to inoculate animals with syphilitic matter, no satisfactory results were obtained until within the last few years. Hunter had made a variety of experiments upon the subject, and had concluded that man alone was susceptible of the influence of the syphilitic poison. Many other physiologists arrived at the same conclusion. Even Ricord, in his treatise on syphilis, says that he had tried to inoculate syphilitic matter, under every possible condition, on dogs, cats, rabbits, guinea pigs, etc., without ever being able to communicate the disease. Until very lately it was, in fact, universally received as an axiom, that human beings alone could be infected with the syphilitic poison. In the year 1844, M. Auzias Turenne commenced some fresh experiments upon this subject. Among his subjects was a monkey, paralytic in his upper extremities, and who, consequently, always remained sitting up; in this position it was impossible for him to lick some parts of his hinder extremities, and M. Auzias found that upon those parts he could inoculate him, but that it was impossible to do so upon parts that he could reach with his tongue. He, therefore, in subsequent experiments, selected the back of the ear, adjoining the mastoid process, as the most favourable situation. He performs the operation with a pair of curved pointed scissors, with which he cuts through the epidermis, so as not at the same time to cause any effusion of blood. The matter to be inoculated is then placed upon the part,

either diluted or not with a little saliva. If the puriform fluid is thick, there is danger that it will dry and congeal around the poison, and so prevent it from producing its action on the surrounding parts. Some amount of dilution is necessary occasionally to prevent this. The inoculated point is kept moist for about a minute, and the skin in the immediate neighbourhood is rubbed gently with a soft instrument, so as to excite vascular action in the part.

The day after this operation, according to M. Auzias, a pimple shews itself on the inoculated spot. The third day a vesicle appears, and twenty-four hours later a pustule. These appearances, which are perfectly regular in their succession, may take a longer or a shorter time in developing themselves; they issue in the formation of a chancre, covered by a crust. The chancre is round and becomes larger; an abundant and deep-coloured suppuration raises the crust, and the epidermis for some distance around the neighbouring skin is warm, red, and swollen. The pus secreted escapes underneath the edges of the scab, which it raises and detaches. The escape of the pus is often assisted by the animal scratching himself, which he is very likely to do on account of the irritation produced.

After a certain quantity of pus has escaped, the parts become less tense. The edges of the scab again adhere to the subjacent parts, or if it has been removed it is formed again in small detached portions. There is some retraction of the epidermis, which becomes starred around the chancre, and is thrown off. The chancre follows its course for several days, and the last-mentioned actions (those which occur subsequently to the formation of the pustule) are repeated several times. At length the sore becomes smaller, and finally disappears without ever having lost its characteristic appearance of a chancre on the skin. "It is possible," says M. Auzias, "to propagate a chancre in this way from animal to animal, in successive descent, for an indefinite number of times, without the virus losing its efficacy."

The fact having been proved that the syphilitic virus might thus be communicated to an animal, some intrepid experimenters undertook the farther task of ascertaining whether the poison, in being transmitted through an animal, had lost any of its virulence, or had become modified in its action.

On the 5th of June, 1850, M. Auzias inoculated a healthy monkey on the anterior part of the right helix, in two places, a little distance from each other.

M. Robert de Wetz, four days afterwards, inoculated himself with the pus derived from the ulceration on the monkey's ear. The operation was performed on the 9th of June, at eleven o'clock in the morning. On that and the following day no results appeared.

On the 12th, in the afternoon, M. Wetz was surprised to find that the epidermis was raised over the inoculated spot by fluid, and that it was surrounded by a red halo.

On the morning of the 13th, the vesicle burst, and a drop of pus of a greenish yellow colour escaped. The red areola had at this time slightly increased.

On the 14th, the inoculation was covered with a light scar, beneath which was a grey lardaceous surface, surrounded by a well defined margin. The subjacent tissues were becoming inflamed, infiltrated, and indurated.

On the 15th, at noon, the secretion of pus had increased. The surrounding tissues were inflamed to some extent, and the motions of the arm had become painful.

On the 16th, the chancre had increased, with an increase of inflammation in the surrounding tissues. M. Wetz now experienced a slight shivering, followed by a sensation of heat, weakness in the limbs, and vague pains in the joints. His head then began to ache, his appetite left him, and the water became of a deep red colour. The next day, all these symptoms had disappeared; but there was a slight eruption

of roseola on the skin. On the tenth day the inoculation was destroyed with Vienna paste.

M. Wetz inoculated himself a second time with the pus taken from the monkey, with similar results, with the exception that the second inoculation on him attained at the same period of its development a much larger size, and the cellular tissue around was inflamed and indurated to a much greater extent. It was, however, impossible to determine whether this induration depended in any degree upon the specific action of the poison on account of the surrounding inflammation.

Not satisfied with these results, M. Wetz inoculated himself with the pus taken from the sore on the monkey's ear a third time. He took the precaution of using only instruments which were quite new, and had never been used. The results this time were not so soon developed. On the first two days nothing appeared; but on the third day it was evident the inoculation had succeeded, and on the seventh day it presented the character of a well developed chancre. This inoculation, like the former, was followed by a violent inflammation in the surrounding cellular tissue. But in none of the instances was there any enlargement of the axillary glands. M. Wetz undertook to make known publicly if any subsequent symptoms showed themselves; and as there has been as yet no intimation to that effect, we must believe that none occurred.

With a courage worthy of a better cause, M. Robert also tried upon himself some similar experiments.

On the 16th of August he took from two simple chancres in full activity, and on the tenth day of their existence, some pus, and inoculated it on the middle of the inside of the ear of a cat three months old, and in perfect health. On the 18th, a hard point the size of a pin's head presented itself.

19th. The puncture was covered by a crust, beneath which was a

superficial round ulceration, a line in diameter, and exuding a milky puriform fluid. This sore was situated upon an induration, which caused a prominence on the outside of the ear, and which could readily be detected by the touch. On the same day, some of the pus from this inoculation was transferred to the corresponding part of the left ear of the same animal.

20th. The first inoculation, covered by a yellowish red crust, presented a circular bluish wound, from which exuded a certain quantity of milky white pus. M. Robert took some of this secretion on a clean lancet, and inoculated himself on the lower and external part of the left arm.

21st. The chancre on the right ear was still hard, covered by a crust, and exuding a milky pus. The inoculation on the left ear was covered by a brown crust, and rested on a circular induration. This scab was removed, and by squeezing the wound a purulent bloody fluid was obtained; with this M. Robert inoculated himself again on the upper and back part of his left forearm.

We will trace the history of these two inoculations separately. But first it may be interesting to see what became of the inoculations on the cat's ears.

On the 22nd, the fourth day of the inoculation, the sore on the left ear was situated upon an accurately circumscribed induration. This was of the size of a split pea, red at its base, and covered by a thick crust, from beneath which a certain quantity of milky pus was expressed. When this scab was detached, a round ulcer was seen, two lines in diameter, and bathed in pus. This pus was, in its turn, inoculated on the ear of another cat. On the third day this inoculation presented a pustule, terminating in a white point, very hard at its base, and surrounded by a red areola.

At this period, the first inoculation, which was done on the 16th (now the ninth day) appeared to be healing, and only presented a

small hard granule covered by a crust. The inoculation of the 19th (on the sixth day) consisted of a very hard circumscribed kernel, covered with a crust. Beneath this was a round ulcer with sharp edges, covered with a milky pus.

On the 25th of August the inoculation of the 16th had healed; that of the 19th was hard and covered by a crust, but on the 28th it had become completely cicatrised. The remaining inoculations, which consisted of many more than I have mentioned, all healed from the eighth to the twelfth day, leaving always after them a little induration which gradually disappeared.

This induration is regarded by M. Auzias as a general consequence of these inoculations. But M. Maisonneuve and others believe that an indurated sore after the artificial inoculation of animals is the exception and not the rule. They say that M. Auzias has mistaken the thickening and condensation of the inflamed tissues for specific induration. To the consideration of this rather important point I shall again advert, only remarking at present, that during these experiments the animals appeared perfectly well, and were not affected, as far as could be ascertained, with any secondary symptoms.

I will now return to the inoculations which M. Robert practised upon himself from the pus derived from the ulcers produced by artificial inoculation on the monkey's ears.

On the third day, the first of these above the elbow was surrounded by a deep red circle, in the centre of which was a pustule as large as a pin's head. This was accompanied with very little swelling or pain.

The fourth day it presented a sore, a line in diameter, with sharp edges, covered by a thick pus of a yellowish colour and surrounded by a red areola. This was proved to be a real chancre, by the secretion from its surface being successfully inoculated on the ear of a cat.

The sixth day, the sore afforded an abundant secretion of pus and was increasing in size.

On the twenty-second day, it was the size of a half franc piece, presenting an irregular surface. The granulations were sometimes pale, and covered with matter which was very easily removed; sometimes red, and secreting a creamy and apparently healthy pus.

On the thirty-second day, healthy granulations appeared; and ten days later the sore was healing, and presented a raised cicatrix.

At the expiration of fifty-seven days, the sore had completely healed.

The second inoculation M. Robert practised, as I mentioned, on the upper and back part of his forearm. On the following day, there was a brown point surrounded by a red areola, darker coloured towards its centre, and slightly raised above the surface of the surrounding skin. The base of the inoculation was hard and infiltrated like an incipient boil. Upon the inner side of the elbow there was a dull pain increased by pressure. On a level with the painful part was a reddish line, arising from the red areola around the inoculation, and proceeding below the elbow to the front, and thence ascending parallel to the vessels and nerves along the inner side of the arm. This was accompanied by headache, want of appetite, and a fixed pain in the left shoulder.

M. Robert now abruptly gave up the idea of trying any more experiments with regard to syphilisation on himself. By the advice of some friends, he cauterised the second inoculation with the Vienna paste. In the evening, the eschar was surrounded by an extensive circle of inflammation. There was pain in the armpit with appreciable swelling, and the arm felt numb and tired. Towards the evening of the next day, a lymphatic gland immediately above the elbow became enlarged and very painful. The lymphatic vessel leaving its upper part could be traced by an inflammatory blush towards the axilla, in which there was a superficial enlargement, painful on pressure. The limb now became hot and heavy. Transient fits of shivering crept over the body, and the palms of the hands were dry and hot.

On the sixth day of the incubation, and on the fifth of the resuscitation, there was an erysipelatous redness around the erythematous swelling of the former, erysipelatous, brown parts in the head, joints and cold erysipelas over the limbs. The swelling of the gland on the inner side of the arm was increased, and there was pain on moving the shoulder.

The sixth day, the wound made by the caustic, appeared, having an irregular plane with sharp edges and covered with a yellowish granulation. The edge of this ulcer below the inflamed gland was undermined, and the whole presented an erysipelatous appearance. There was much pain and tenderness of the wound. The whole arm was inflamed, with burning pains in the joints. Some matter below them the surface of this wound was now successfully inoculated on the ear of one of the rats, showing that the poisonous character of the virus had not been destroyed by the caustic.

On the twentieth day, an opening was made into the swelling on the inner part of the arm, and a quantity of white firm pus was evacuated.

On the thirtieth day, the incubation was still protracted. It presented a gangrenous and bleeding surface with a hard base, surrounded by some distance with erysipelatous infiltration.

On the twenty-first day, it had become less painful, but still presented a gangrenous and bleeding surface, with hardened and sharp edges.

On the thirty-first day, the surface of the ulcer was becoming cleaner and its edges less prominent: the colour and swelling had disappeared, but the edges of the wound left by the suppurated gland were thickened, and had a syphilitic appearance.

On the forty-first day, this ulcer had again assumed a gangrenous surface. Its edges were undermined, inflamed, and very painful. The putrid discharge was tinged with blood. The wound resulting from the

What effect does the following have on the target population? (1000)

4. *Impaired ability* that the members of the same group perceive another group as being more likely to be involved in violence.

John Gilling, from his file of August 18, 1950, of Chicago. In summary of 1957 record, and the police handling from 1949-1950, 1951-1952.

18. Robert Hall at the time regarded his political beliefs and other political opinions as "latent" assumptions. The rest of the evidence just cited showed an intention of having his faith "manifested" and his own religious philosophy of the Gospel made more "explicit" by his conversion.

From his experiments, H. Koller, reports in the *Journal of the American Chemical Society*, that the addition of a small amount of water to the reaction mixture, which he says will increase the yield of the product.

When that you're terrified to be seen, or at least afraid, I estimate or otherwise started something. But now there's still a few more. When someone is with a person who is a member of the same group, it's possible that you can't see them. But you can.

The alternative is usually taken as a primary consideration in the design of structures in both welded plate structures and the structures with secondary structure.

When several individuals are made to live under identical conditions, but put to different forms of activity (such as those seen in the first two different forms of long distance blood flow tests). They all follow exactly the same course.

In this last chapter, M. Bédard's argument is strengthened with that of M. Lucie Tremblay.

LECTURE V.

ON SYPHILISATION AS APPLIED TO MAN.

IN my former lectures, I mentioned that artificial inoculation gave rise, under different circumstances, to different classes of local affections. In the first of these, the symptoms were those of the adhesive inflammation. I mentioned that, in this class, the secretion from the inoculation consisted, during the first days, of a thin fluid, which gradually became more turbid; and that the parts in the immediate neighbourhood subsequently became indurated in a very peculiar and characteristic manner. In the second, the inoculated part at once ulcerated, and, in general, produced a suppurating bubo. In the third, the inflammation terminated directly in suppuration of the part to which the poison was applied. Artificial inoculation on animals, we had reason to believe, did not produce the second of these kinds of local affections; but they did produce the first and the third. In man, artificial inoculation has comparatively rarely been known to produce the first, but seldom the second, and very frequently the third. The reason of this I presume to be, that the inoculations have in man almost always been performed upon those whose systems were already under the influence of the syphilitic poison, and that this circumstance has tended to modify the results of the experiments which have been performed.

The experiments on animals, originating with M. Auzias Turenne, excited little general attention until a memoir was read before the Royal Academy of Medicine and Surgery at Turin, by Dr. Sperino, on the 23rd of May, 1851. In this communication, Dr. Sperino announced that a vaccination had been discovered for syphilis as for small-pox, and intimated his belief that a prosecution of this subject would bring to light the true method both of preventing and curing the disease.

Dr. Sperino mentions that he had long observed that the women committed to his care, who were the subjects of large primitive syphilitic ulcers, or who were affected with phagedenic or gangrenous sores, rarely became affected with constitutional syphilis; and that the patients who returned to the *Syphilicome* several times with primary affections were comparatively seldom attacked by any secondary disease: but that the patients who came from the country, and who had for the first time a chancre, were generally thus affected at the end of three or four months. Again, he observed, that patients who presented themselves with open virulent buboes, and in whom several inoculations were made, not only soon recovered from their local disease, but did not subsequently suffer from constitutional affections.

From these and other observations, he was led to believe that secondary symptoms do not manifest themselves in direct relation to the extent, and number of the primary ulcers, but, on the contrary, that constitutional syphilis presents itself in inverse proportion to the number of these ulcerations.

On the 18th of November, 1850, M. Auzias Turenne announced to the Academy of Sciences at Paris that, after having inoculated the primitive ulcer several times on animals, and especially on monkeys, he had constantly observed that the first ulcer showed itself more quickly than the following. He found also that it became larger, secreted more pus, was accompanied by more active inflammation,

and lasted longer than the second. He concluded that the third inoculated ulcer bore the same relation to the second as the second did to the first, and so on until the animal became proof against any further inoculation. The animal was then said by M. Auzias to be "syphilised". This announcement appeared to Dr. Sperino to shed a great light upon the subject, and especially to illustrate the observations which he had previously made. He was especially struck with the analogy which appeared to him to exist between the experiments of M. Auzias and that which he had observed with regard to those patients who had contracted several sores in succession, and at short intervals of time.

But the supposed facts appeared still of little value, so long as the experiments upon which they were founded were confined to animals. Dr. Sperino therefore set about applying the "marvellous facts", as he calls them, brought to light by M. Auzias's experiments upon animals, in good earnest, to the treatment of human beings. During five months, he subjected, in presence of several of his colleagues, fifty-two patients affected with syphilis to this mode of treatment.

The inoculation in these cases was always made with a lancet, three or four separate punctures being made each time, generally upon the abdomen. The inoculation was repeated once or twice a week, and the punctures were always covered, so as to retain the inoculated matter in contact with the part. The pus was always taken from a chancre during its period of progress. On the third, and rarely on the fourth day of the inoculation, the syphilitic pustules showed themselves, and immediately afterwards appeared the primitive chancre, with all its characteristics. In all the cases, without exception, Dr. Sperino found that the first artificial ulcers became larger than the second; they secreted a larger quantity of pus, lasted longer, and left after them larger cicatrices than those which followed.

The second ulcerations were smaller, less inflamed, less painful,

more superficial, than the first; the third than the second; and so on until, after a certain number of inoculations, in general from eight to ten (three chancre being produced each time), it was only possible to produce a little pustule, which disappeared spontaneously in five or six days. After that, other inoculations remained without any result, although the pus was taken from fresh persons affected with recent sores. This same pus, inoculated upon other patients, never failed to produce its characteristic ulceration.

In patients who had already large and old ulcerations (and who, Dr. Sperino believes, were already in a measure saturated with syphilitic virus), the first artificial ulcerations were small, and it was not possible to reproduce them after a few inoculations.

Arrived at this point, Dr. Sperino believed his patients syphilised, that is, incapable of further syphilitic contagion, as M. Auzias believed the animals to be upon which he had made his experiments.

"It is certain", says Dr. Sperino, "that of all the women who entered five months ago into the *Syphilicome*, and whom I syphilised to the highest degree, not only have none hitherto been affected with constitutional symptoms, but the health of each of them has gradually improved since the active stage of the first artificial ulceration, to the end of the experiments to which they were subjected."

It is true that this account differs somewhat from that which Dr. Sperino subsequently gives in his book published at a later period. In this work, it is said that, out of fifty-two patients affected with primary syphilis, the plan of treatment by repeated inoculation was successful in fifty, and unsuccessful in two; out of forty-three patients affected with constitutional syphilis, twenty-six were treated by syphilisation, and twenty-five were cured. In six instances, the iodide of potassium was used in conjunction with syphilisation; and in eight cases, syphilisation, iodide of potassium, and mercury, were all employed. In three cases, it was found necessary to discontinue the inoculations, and two patients died.

This rate of mortality appears very high ; for in this country, where the disease presents itself under perhaps severer forms than in any other, we very seldom have to register a death from syphilis alone.

Of fifty-three patients treated for primary syphilis, only three are reported to have presented themselves, at the time the book was written, with secondary affections ; but it has since been said that others subsequently made their appearance, and were again admitted into the hospital for secondary symptoms.

The patients who presented themselves for secondary disease were again treated (cured, it is said) by fresh syphilitic inoculation.

The facts given by Dr. Sperino bear upon the face of them the evidence of having been collected by a very enthusiastic observer ; but, even supposing them to be all true, yet the length of time occupied in the treatment does not appear very encouraging.

Excluding the cases treated with mercury, and the cases in which the treatment was interrupted, Dr. Sperino gives us seventy-six cases in which the supposed immunity against the effects of syphilis produced by repeated inoculations might be observed. Of these, the effect is said to have been produced in less than a month in one case ; in from one to three months in four cases ; in from three to six months in seven ; in from six to eight months in eight ; in from nine to twelve months in eight ; in from twelve to fifteen months in twenty-one ; and from fifteen to seventeen months in twenty-seven. Thus we see that there is a gradually increasing number of cases requiring a corresponding increased length of time for their so-called syphilisation : and it is difficult to imagine why, if so large a number as twenty-seven remained unsyphilised after fifteen months, none should remain in the same condition after seventeen months, and why that there should have been no recurrence of the disease after this period.

The mode of treatment pursued by Dr. Sperino, and its effects, may be illustrated by the following cases.

CASE I. A. C., sixteen years of age, of good constitution, was admitted into the hospital on the 9th of May, 1851. She then had an indurated syphilitic ulcer on the internal and lower part of the right labium, and two other non-indurated sores at the orifice of the vagina. She was now affected for the second time, and had been ill a fortnight. Four months previously she had taken a hundred and twenty pills for a primary syphilitic affection, said to consist of an indurated sore.

On the 12th of May, after having administered purgatives, and ordered a bath, Dr. Sperino inoculated three points on the right hypochondriac region with the matter taken from a primitive indurated sore. There arose on these points three little vesicles, which, on the third day, were converted into pustules, surrounded by an inflammatory blush.

May 15th. Three inoculations were made with the same pus, and three pustules were produced.

May 22nd. Three fresh inoculations were made with pus taken from a fresh patient.

May 26th. Only one of the last three inoculations had produced a pustule.

May 29th. The inoculations were again repeated, and produced three pustules. The ulcers produced by the inoculations first made were larger than those resulting from the second operation, and these were again larger than those subsequently formed.

June 3rd. Three fresh inoculations were made with a positive result. The primary ulcer for which the patient was being treated had healed, but the induration remained.

June 7th. From this day to the 1st of July sixteen punctures were made, at seven different times, with pus derived from sores of other patients in a state of progress. Only four abortive pustules showed themselves as the results of these sixteen inoculations. The

ulcers arising from the inoculation of the 22nd, 26th, and 29th of May, and the 3rd of June, did not become large, and were healed towards the end of June, at the same time as the sores produced by the first inoculations on the 12th of May. The induration, which had existed after the cicatrisation of the ulcer on the right labium, gradually disappeared; at the beginning of July there was no longer any trace of it.

July 2nd. Two inoculations were performed, and were followed by two pustules.

July 3rd. Three similar inoculations were followed by the same positive results.

From the 9th to the 21st of July, eighteen punctures were made, at five different sittings, all of which were followed by little pustules having a characteristic appearance. These, however, healed in a short time (from eight to ten days), and left scarcely a trace of their existence.

July 26th. Three inoculations were made with the pus derived from the inoculations of the 3rd of July. Three pustules resulted, smaller than the preceding.

July 27th. Eight inoculations were made; and four more on the 30th.

August 4th. Twelve small pustules appeared. The sores resulting from the inoculations of the 2nd and 3rd of July were already dry and cicatrised.

From the 4th to the 22nd of August, twenty inoculations were made with well chosen pus. Six little pustules resulted, which were healed in five or six days.

This patient was kept in the hospital until the 13th of September, when she was allowed to depart, after having remained in the hospital for four months and four days, and been inoculated eighty-nine times.

No constitutional symptoms, it is said, showed themselves in this

ease, and the patient left in perfect health. Six cicatrices on the hypochondriac regions were the most visible; the others, although numerous enough, were small; they all were gradually becoming fainter. This patient was considered almost syphilised.

CASE II. A. B., aged sixteen, was admitted into the *Syphilicome* on the 1st of August, 1851, affected with a primary syphilitic ulceration on the anterior lip of the neck of the womb. There had been no previous disease.

August 3rd. The pus from the ulcer on the neck of the womb was inoculated in two places on the right hypochondriac region.

August 4th. The points where the pus was inserted were slightly red.

August 5th. A little vesicle had appeared upon each.

August 6th. The syphilitic pustule had appeared at the two points; there was some fever.

August 7th. The fever had increased; the pustules broke, and exposed primary syphilitic ulcerations; the base of these began to feel slightly indurated.

August 8th. The pus from the last named pustules was inoculated on the corresponding point on the left side in two places.

August 11th. Two pustules had appeared in the situation of the last inoculations. The two first artificial ulcerations continued to increase: they were indurated, and presented all the characteristics of the Hunterian chancre.

August 13th. The pustules arising from the inoculations made on the 8th had been open for the last two days; the sores left were smaller, less inflamed, less hard, and less painful than the first.

August 15th. Seven inoculations were made with the pus from the first artificial sores, under the right breast.

August 18th. Seven little pustules had resulted from the last inoculations.

August 21st. The ulcers from the inoculations made on the 15th were smaller and less painful than those made on the 8th. Eight fresh inoculations were performed with the pus derived from the second series of artificial sores.

August 24th. Eight pustules had resulted from the last-named inoculations; but these ulcers were small, and surrounded by a faint inflammatory areola. The first and the second series of inoculations were beginning to heal; the others were small, and remained stationary. Six fresh inoculations were made with some virulent pus taken from another patient.

August 31st, Three out of the four sores produced by the first inoculations were cicatrising; the fourth was also healing. Those resulting from the inoculations performed on the 24th were beginning to dry up. Twenty punctures were now made with a lancet charged with virulent matter from a fresh patient.

Sept. 2nd. Twenty little pustules, but slightly inflamed, had resulted from the last inoculations; nineteen similar punctures were made on the left side of the chest.

Sept 18th. The ulcers resulting from the inoculations performed on the 31st of August, and on the 2nd of September, had gradually diminished in extent, and had cicatrised. Fifteen inoculations on the right side of the chest were performed, and on the 20th six more.

Sept. 22nd. The inoculations of the 18th and 22nd had given rise to small abortive pustules. Five fresh punctures were made.

Oct. 2nd. The pustules from the inoculations practised on Sept. 18th and 20th had not burst, but had dried up; the inoculations of September 22nd had remained without result.

Oct. 13th. There were no longer any traces of pustules. The induration of the first artificial ulcers had entirely disappeared. During this plan of treatment no internal medicine was given, with the exception of some refrigerating drinks when the skin was hot, or the pulse frequent.

During the period of the first inoculations some slight fever was present. In other respects, this patient enjoyed excellent health. The cicatrices had almost entirely lost their coppery hue when she left the hospital on the 13th of October.

It is inferred in this case that the fever observed on the 6th and 7th of August may have been the syphilitic fever, or that fever which precedes the syphilitic eruption; and therefore that such an eruption might have been expected had not the syphilitic inoculations been made.

CASE III. C. B., aged sixteen, was admitted into the hospital on the 20th of March, 1851, with two large primary ulcers, open for ten or fifteen days, and for two buboes, in which evident fluctuation could be detected. This patient was diseased for the third time, but had only once been treated with mercury: she then used forty frictions, and took fifty-six pills of proto-iodide of mercury.

March 31st. Two inoculations were made on the abdomen, and two pustules were produced; on the 7th, the 10th, the 14th, and the 17th of April, two inoculations were performed, followed each time by ulcers smaller than the preceding. All the ulcers remained superficial and small.

April 28th. The ulcers resulting from the above inoculations were almost all cicatrised. Three fresh inoculations were made on the abdomen, and three more on the following day. These were all followed by little pustules.

May 8th. Three inoculations on the abdomen were not followed with any result. The two buboes had become indolent, smaller, and fluctuation could no longer be felt in them.

On the 15th, 19th, 22nd, and 29th of May, and on the 4th of June, divers inoculations were performed, which gave rise to little pustules. The primary ulcers, for which she was admitted, had recently become cicatrised, and the artificial ulcers were healed.

From the 7th of June to the 19th of July, thirty-five inoculations were performed at short intervals. From these, sometimes no result at all was produced; sometimes nothing but little pustules were produced by the puncture, which healed in four or five days, without leaving behind them any marks of their existence. But on the 19th of July an inoculation gave rise to a little pustule, the scab of which being raised on the 24th, left a small ulcer, having the characters of a syphilitic sore; on the 30th of the same month this sore was entirely healed.

From the 19th to the 31st of July, twenty fresh inoculations were made without any positive result.

On the 17th of August, this patient left the Hospital, having resided there four months and twenty days, and having enjoyed uninterrupted good health during the whole of that time.

It is to be observed, regarding this case, that no information is given with regard to the sources whence the inoculated pus was derived, and that, if left to itself, it is not a case in which secondary symptoms might have been expected. But the inference deduced from it is, that syphilisation, among other wonderful properties, has that of producing absorption of matter from a suppurating bubo.

The advocates of this plan of treatment insist that repeated and successive syphilitic inoculations, carried to saturation, induce not only an immunity against the infection of this same virus, but that they serve to cure the different syphilitic symptoms, primary as well as secondary.

This point, it might be said, is illustrated in the following case, reported by M. Zelaschi.

CASE IV. Charles T., aged twenty-nine, contracted a syphilitic ulcer in November 1850, which left an induration in May 1851. At this time, he again contracted a primary syphilitic sore on the mucous membrane of the upper part of the prepuce.

June 22nd. The treatment by syphilisation was commenced with two punctures on the right thigh with a lancet charged with the discharge from the primary sore upon the prepuce.

June 25th. Two little pustules had made their appearance. Two fresh inoculations were performed, and *two days* afterwards were succeeded by two pustules.

June 27th. The patient complained of pain in the left groin, where an enlargement was discovered of the size of a pigeon's egg. Three fresh inoculations were made on the left thigh, and gave rise to three pustules.

July 1st. Three inoculations with the pus derived from the artificial sores gave rise on the third day to the same number of pustules.

The ulcers produced by the two first inoculations were very painful. The primary ulcer on the prepuce continued to increase.

July 5th. Two inoculations were made on the right thigh; three on the left.

July 8th. Four more inoculations were made on the left, near the last mentioned. All these were followed, *from the second to the third day*, with characteristic pustules. The matter from a blennorrhagia, with which the patient was also affected, was now inoculated, but produced no effect.

July 10th. The ulcers from the first inoculations were very painful, and secreted a great deal of virulent pus. The ulcers produced by the subsequent inoculations were of smaller extent than those produced by the first.

The bubo was stationary and indolent. The primary ulcer on the prepuce had continued to increase. It was of a brick red colour, much inflamed, and had destroyed a considerable portion of the prepuce. The inoculations were now interrupted.

July 21st. Some symptoms of fever had existed since the last report, for which the patient was bled.

July 29th. The primary ulcer on the prepuce, and the sores resulting from the inoculations, were less inflamed. The ulcerations produced by the first inoculations appeared to be still poisonous; all the rest were healing. The sores produced by the fifth, sixth, and seventh series of inoculations were almost cicatrised. The swelling in the groin had well nigh disappeared.

August 4th. The ulcers produced by the last three series of inoculations were healed, and the others were healing on the 14th of August. Thirty-five days after the inoculations were discontinued, some constitutional symptoms appeared: on the back and thighs, and other portions of the body, slightly raised patches of a coppery colour were visible; and on the 18th and 19th the patient was affected with periosteal pain of the tibia. The primary ulcer had now destroyed the upper part of the prepuce, and eaten away part of the corona glandis. The cutaneous spots were becoming confluent.

In this rather uninviting state of things, M. Zelaschi bethought himself of again having recourse to syphilisation, but before doing so sought the advice of Dr. Sperino with reference to the case. It was then agreed that syphilisation should again be had recourse to, and that it should be vigorously prosecuted.

Accordingly, on the 20th August, twenty punctures were made with pus derived from other syphilitic patients, and twenty pustules were produced.

August 23rd. Fourteen punctures were made with a lancet charged with pus taken from the sore on the patient's prepuce, and twelve pustules resulted.

August 30th. The general state of the patient was described as very satisfactory. The primary ulcer on the prepuce was no longer extending itself. The ulcers arising from the inoculations of the 20th were inflamed and painful. Fifteen fresh punctures gave rise to eleven pustules.

August 31st. The pain of the tibia was now scarcely perceived by the patient. The eruptions had not progressed. The ulcers from the inoculations performed on the 20th were healing.

Twenty inoculations were now made with the pus taken from the sores resulting from the punctures of the 23rd. Eighteen little pustules resulted.

Sept. 6th. The ulcers produced by the inoculations of the 20th and 23rd of August were dried up.

Five fresh inoculations with pus derived from fresh patients gave rise to five pustules.

Sept. 12th. Nine inoculations with the pus derived from the sores produced on the 6th. These gave rise to little pustules. With the same matter on the 15th, six inoculations afforded no result.

Sept. 20th. Twenty inoculations with pus derived from fresh sources. Seventeen pustules resulted, which had dried up on the 29th without having burst, with the exception of two, which still remained moist.

From the 25th of September to the 1st of October, fifteen inoculations were made; no result showed itself from these.

Oct. 8th. Eight inoculations; three little pustules resulted, of the size of the head of a pin, which dried up in less than three days, without having been broken.

Oct. 9th. Nearly all the syphilitic spots had disappeared, an abundant desquamation covered the whole body, and especially the regions where the spots had been the most confluent.

Oct. 11th. Six punctures were made, and on the 19th ten more. These afforded no results. The matter for the inoculations of the 25th of September and the 19th of October was taken from indurated sores in a state of progress in other patients. This virus was proved to be eminently active when tried in other cases.

All the syphilitic symptoms, both primary and secondary, had now disappeared, and the patient resumed his ordinary occupation.

LECTURE VI.

SYPHILISATION (CONCLUDED).

IN the examples of artificial inoculation which we have hitherto considered, suppuration of the inoculated points has been a very general and marked result. In different cases we have found that this action has taken a greater or less time to develop itself, but that the inflammation produced by the artificial inoculations has generally been, from the first, of the suppurative character. In these cases, so far as we have yet seen, no additional constitutional effects have followed the artificial inoculations. In this respect, the cases have afforded examples of the law which I dwelt upon in a former lecture; viz., that when a sore from the first suppurated (whether it was induced by artificial or by natural inoculation), no constitutional symptoms would be likely to result.

Suppuration, in general, is produced with great difficulty in animals. It is not easy, by any simple lesion, to produce in them a discharge of well formed pus. The readiness with which this action is induced in artificial syphilitic inoculation at once tends to support the idea that animals are susceptible of the specific influence of this morbid poison, and to indicate the mode in which nature in them eliminates the virus when artificially introduced into a part. The distinct and characteristic morbid action to which the syphilitic poison has been shown to

give rise in animals, appears to me to contradict the idea which has been maintained by some, that the virus may simply remain dormant in the inoculated part, being diluted and mixed with any secretions with which it may come in contact; and that, when in this diluted state it is again reinoculated upon man, it may again resume its peculiar activity. Such an idea, I say, appears to me to be inconsistent with the distinct morbid action which results from artificial syphilitic inoculation of animals, and the spots of suppuration in them which are thereby induced. The pustules in the cases before recorded were found to have been formed sometimes in two, and very generally in three days; and, although in the last series of inoculations performed in any case, very little inflammation of any kind appears often to have been produced, yet that which did exist was of the suppurative character. This circumstance renders it extremely probable that the induration which was felt at the base of these artificial inoculations arose from the general infiltration of the surrounding tissue which usually accompanies suppurative inflammation, and not upon any peculiar and specific adhesive inflammation of the inoculated part.

Attempts to induce the state called "syphilisation" have not been so successful in France as in Italy. For although it has been found that patients gradually become less and less susceptible to the influence of the specific matter derived by successive formations of pustules on themselves from the same original source, yet it has been shown that these same patients might generally be inoculated as at the commencement, when the pus was derived from a fresh patient.

The following cases are recorded by Dr. Thiry of Brussels:—

CASE. A patient, who had had a variety of primary and secondary syphilitic affections, and had been subject to anti-syphilitic treatment for an indurated sore, was admitted into St. Peter's Hospital on the 4th of October, 1851. Several primary ulcerations existed at this time.

Oct. 7th. Three inoculations were made upon the abdomen from one of the primary sores. In twenty-four hours, each presented the characteristic pustule and areola.

Oct. 8th. Three inoculations were made as before.

Oct. 9th. Three inoculations were made with the pus derived from the first inoculations.

Oct. 10th. Three inoculations were made with the pus produced by the inoculations of the 7th. These had not increased in size, and were covered by a crust, which, when raised, allowed the escape of a considerable quantity of virulent pus. The inoculations made on the 9th had succeeded.

Oct. 11th. Three fresh inoculations were performed with the pus of the chancres inoculated on the 8th.

Oct. 12th. Three areolar pustules had followed the inoculations of the previous day. The pustules produced by the inoculations of the 10th showed a tendency to fade. Under each pustule there was some thickening of the cellular tissue, but not the least sign of specific induration.

Oct. 13th. The different inoculations, after having somewhat enlarged, faded away, and presented the starred appearance of some cicatrices.

Three inoculations were repeated on the 14th and 15th respectively. The latter became less developed than the former.

Oct. 16th. Three inoculations were made with the pus of the chancres inoculated the day before.

Oct. 17th. The inoculations of the 16th had succeeded, but in a very slight degree. Three fresh inoculations, made with the secretion of the most active sores, were followed by positive results.

The inoculations were continued on the 18th, 20th, 21st, and 22nd.

Oct. 23rd. The last inoculations had now only produced a slight papular elevation, having no characteristic appearance.

Oct. 24th. Three fresh inoculations were made with such remains of purulent matter as could be collected from the different sores; one only of these inoculations gave rise to a papular elevation similar to those before mentioned; the other inoculations afforded no result.

Three similar inoculations on the 25th ended in a papular elevation, still less marked.

On the 26th, 27th, 28th, and 29th, all the inoculations became cicatrised without induration. Some further attempts were made to inoculate this patient from the secretions of her own sores, but in vain; nothing further was produced. But, on the 1st of November, this same patient was inoculated with the matter taken from the sores of another woman, who had also been subject to this treatment by syphilisation.

Nov. 2nd. The inoculation had succeeded; a vesicular pustule had appeared, surrounded by a red areola, faint, it is true, but still characteristic. This vesicular pustule contained a sero-purulent fluid, which was again inoculated, and again produced its specific effects. Another series of inoculations was now again commenced from this fresh source of infection, and the inoculations all succeeded as at the first. At length, after fifty-seven inoculations in all had been practised, the experiment was given up.

The inoculated sores were healed as soon as possible, and the patient left the hospital in the beginning of December.

In a second case, the attempt to induce syphilisation was given up after sixty-three inoculations had been made, all of which succeeded; and in a third case, after twenty-five artificial ulcers had been produced.

Such cases furnish a sufficient refutation of the idea that the state known or imagined as syphilisation can be, at will, artificially produced; yet have we, on the other hand, direct evidence that individuals, and even nations, from artificial or natural causes, become

susceptible to the influence of the syphilitic poison in extremely different degrees: and we have conclusive testimony, as I believe, that the repeated inoculation of syphilitic matter, whether by artificial or natural means, tends powerfully to produce such a modification of the effects of the poison.

In the first place it must, I think, be admitted that, as a rule, syphilitic matter, derived from the same original source, gradually loses its influence after successive inoculations. Exceptions may occur to this as to every other rule; but as far as the evidence upon this point has hitherto gone, it tends to prove that the poison derived from the same source gradually loses its effect when successively applied to different parts of the same patient. Some of you had an opportunity of observing the following case, for the notes of which I am indebted to Mr. Grylls, our house-surgeon.

CASE. H. C., aged twenty-one, came under treatment on the 2nd of February, 1854. She had then a syphilitic eruption of eleven weeks duration. There were several chancres about the inferior commissure, anus, and inner margins of both labia. The inguinal glands were slightly enlarged and indurated, and there was enlargement of the right nympha, with vaginal discharge.

February 4th. Several spots were inoculated on the right natis, from the angry looking sores on the margin of the anus and labia.

February 6th. Several fresh spots were inoculated on the left natis, from other angry looking sores.

February 11th. Each point inoculated produced a small pustule: several fresh inoculations were made with the pus of the original sores and of the artificial inoculations.

February 13th. Upon each last inoculated point a vesicle had appeared.

February 14th. Each vesicle had become pustular.

February 16th. The left natis was now inoculated in several spots

from the sores, both natural and artificial, which furnished the largest amount of secretion. Eighteen hours afterwards, the inoculated spots were found to be slightly reddened.

February 18th. Forty-four hours after the inoculation, no effect was perceptible. Several fresh spots were inoculated with the pus of the sores near the anus and from those artificially produced, on the inner side of the right natis.

February 23rd. The last inoculations had produced no effect. The inoculations of the 11th were forming small dry scabs. The eruption had now faded.

February 24th. Several spots were inoculated over the sacrum with as much remaining secretion as could be obtained from any of the sores.

February 27th. The inoculations of the 24th had taken no effect.

February 28th. All the inoculated and other primary sores had healed, without leaving any induration.

This patient was considered to have recovered on the 2nd of March, having been under treatment exactly four weeks, and having during the last two weeks been apparently insusceptible of any farther inoculation by means of the secretion derived from her own sores.

It is probable that, in this case, if the matter had been taken from a fresh patient, the inoculations would have succeeded. But this experiment was not considered either necessary or justifiable. The treatment adopted consisted of the compound steel pill, and of some saline medicine at a time when there were some slight feverish symptoms.

It may be remarked, with regard to this case, that the eruption had persisted for some weeks before the patient came under observation, and that it would probably have faded in something like the same time had she not been subject to any treatment at all.

The length of time that this patient had been diseased will also

probably account for the little susceptibility she showed to any farther infection.

The results obtained by experiments agree in this respect with those derived from the observation of the natural course of the disease. It will constantly happen, that persons habitually exposed to contagion, or those who have long suffered from syphilitic disease, will at length become little liable to any fresh syphilitic influence from natural causes.

There are some who enjoy a comparative immunity from syphilitic infection. What the conditions are which confer this peculiarity have not been satisfactorily ascertained. But there can be no doubt that, while in some individuals it is found to exist naturally, in others it may, for a time at least, be acquired.

This peculiarity is found to exist, not only among individuals but also among large classes of people, and even to extend to nations. In nations, as in individuals, this comparative immunity may be natural. In both it may, in some degree, be acquired. Whoever will take the trouble to look over the hospitals of France, and compare the cases there seen with those treated in the hospitals in England, will be struck with the mildness of the symptoms in the former as compared with the latter. Yet there have been periods in the history of the disease in which the French have suffered most severely. Now, however, it appears, by successive transmission, to have become so modified as scarcely to appear to be the same affection. Some French authors, and among others MM. Maisonneuve and Montanier, have supposed that a diseased parent has transmitted the immunity which he had acquired in some measure to his offspring; and that thus, through a series of transmissions, the disease has gradually become modified for the whole nation.

It must be admitted that any animal poison may become more or less active in its operation, from various causes, quite independent of

any peculiarity in the constitution of those affected. But a greater or less activity of the poison itself will certainly not account for the facts which have been noticed regarding syphilitic infection. It is well known that individuals exposing themselves to the same source of disease will often be very differently affected; the same thing is true with regard to nations. In the year 1812, it was noticed by Dr. Fergusson that the British army suffered most severely during the four years that it had then been in Portugal, while the inhabitants of the country had the disease in very mild forms. They were "cured by topical remedies alone, and," says Dr. Fergusson, "I have lived long enough among them to ascertain that their return to hospital under such circumstances for secondary symptoms is far from an universal, or even a frequent occurrence. The venereal lists amount to forty-six, and two of them only are taking mercury. None of the ulcers are such trifling cases of chancre as we have seen at home, nor even such as an English soldier would run with affright to seek the succour of his surgeon. To these, the Portuguese soldier pays no attention whatever; he does not consider them to be a hindrance to him in any manner, and I have seen him turn out for duty with ulcers that made me shudder to look at, though both he and his medical attendant considered them as nothing."

While the native soldiers were thus treated by topical remedies alone, and seldom had any constitutional symptoms, the British often "sustained the most melancholy of all mutilations," and the venereal ulcerations in them were not only "found more intractable to the operation of mercury than under similar circumstances at home", but the constitution, even while under the influence of the remedy, became affected with the secondary symptoms in a proportion that could not have been expected. Such were the very different results in the two classes of persons infected from the same sources. In the one, whose constitutions appeared to have become familiarised with the disease,

it produced, as a rule, only its local effects; in the other, who did not enjoy the same unenviable privilege, not only were the local affections more severe, but the system became often affected, and that in spite of appropriate medical treatment.

From such considerations, it will at once appear how fallacious any conclusions are likely to be that are derived exclusively from the observation of patients, whose constitutions have already been influenced by the disease, either in its direct or hereditary forms. Any data derived from venereal hospitals, unless care be taken in the selection of the cases, may from this cause prove utterly valueless when applied to cases met with in private practice; and especially are the facts furnished by any particular class of persons liable to mislead, if inadvertently applied to another class, placed in a different position. Thus, from observations made in the army, Mr. Rose, in the year 1817, published a paper on the treatment of syphilis, with an account of several cases of that disease in which a cure was effected without mercury; and, from his experience among soldiers, he was led to believe that he might adopt the same means of treatment in private practice. But we have it recorded, on the authority of Sir B. Brodie, that here it was unsuccessful, and that Mr. Rose was at last induced again to have recourse to mercury in the treatment of syphilitic affections in private. Since Mr. Rose's publications, many other army surgeons have adopted the non-mercurial plan of treatment, and have continued it up to the present time. This they certainly would not have done, had they not found it successful. But it must be remembered that the cases which they have to do with occur in those who are often in some measure syphilised. The patients whom they see have comparatively rarely the disease for the first time; their systems have in some measure become accustomed to the influence of the poison, and the forms, both of primary and secondary disease in them, are most materially

modified thereby. A person who has repeatedly contracted primary syphilis is in some measure placed under the same circumstances as a patient who has been repeatedly inoculated artificially; and we possess sufficient evidence, derived both from observation and experiment, to show that, under such circumstances, the local disease is altered in its characters, and that no additional constitutional affection is likely to be induced.

The modification of the action of the syphilitic poison, in consequence of repeated inoculation, although it has of late years assumed a new name, is not, as we have already seen, a new subject. The conclusion to which Dr. Fergusson arrived in the year 1812 was, that the disease had become so much mitigated in Portugal, by reason of general diffusion or other causes, that, after running a mild course, it exhausted itself, and ceased spontaneously. Dr. Fergusson further mentions, that at that time, he had reason to believe that in other countries the disease had become modified in a similar way; that in certain German regiments, and in some districts of the Russian empire, the medical attendants had found that mercury was not necessary for the treatment of syphilis; and that, in the patients to whom he referred, the disease, from being allowed to run its course probably for ages, had become as weak as it was found to be in the Portuguese.

The conclusion arrived at by Dr. Fergusson is remarkable, as furnishing a means of accounting for what he had himself observed, and as having been revived and adopted to account for the more extended series of observations and experiments of the present day.

All adventitious diseases, he says, that are not connate, endemic, nor sporadic, appear more or less to run this course of exhausting themselves while retained upon the same ground to which they have been transplanted. But let the field be changed, and fresh sources of development be presented, they instantly resume their primary powers, and, taking a fresh departure of violence, repeat the almost

forgotten inflictions of their original visitation. The powers which they thus acquire bear some resemblance to a phenomenon which is every where observable in the vegetable kingdom. The same species of seed may be sown upon the same ground, until it shall so degenerate in point of vigour as to become almost incapable of reproducing itself; but let it be changed to any other of any kind, though even of far inferior quality, it will immediately display new powers of life, and fructify and vegetate with its native strength. Similar to the above appears to be the inoculation of the exhausted syphilitic virus of Portugal (though evidently the same disease) into the constitution of the British or other stranger. It is in some measure new, therefore unfriendly, and seems to have the power of exciting new actions of more than ordinary violence.

The Portuguese, through apathy, and at a dreadful price levied on the generations that are passed, and never, in all probability, to be redeemed by their descendants, appear to have gained a great exemption from both syphilis and variola; but the price is too high for us ever to offer up our bodies to be the unresisting subjects of disease, the fatal consequences of which, though they might go far to extinguish one or two ills, would be felt in the deterioration of our race to the most distant ages.

THE END.